

Military & Aerospace Electronics®

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THE MAGAZINE OF TRANSFORMATION IN ELECTRONIC AND OPTICAL TECHNOLOGY

Power electronics

Warfighters in the field rely on novel power electronics to drive mission-critical systems. **PAGE 26**

Avionics displays

Manufacturers embrace commercial technology, but ruggedization challenges remain. **PAGE 34**

KEEPING MILITARY SECRETS



Anti-tamper technology ensures that critical systems information stays in the right hands. **PAGE 18**

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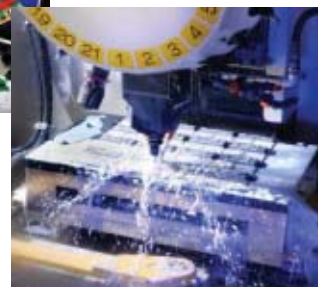
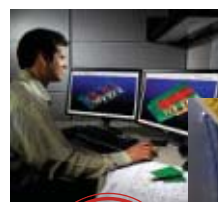
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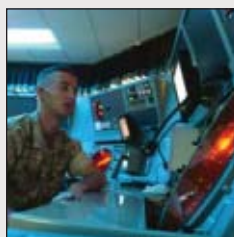
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The U.S. military's most closely guarded secrets are intended to stay in the right hands as the Department of Defense and the defense industry continue to develop and refine anti-tamper technology. With this kind of technology in place, the most critical information remains secret—even if major weapon systems, such as the F-35 jet fighter shown on the cover, fall into an adversary's hands. **Page 18**

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Enhanced Mil & Aero Web site just keeps getting better



By **JOHN KELLER**
EDITOR IN CHIEF

If you haven't already seen it, surf on over to the redesigned *Military & Aerospace Electronics* Web site at www.milaero.com, which incorporates news and feature content from *Avionics Intelligence*—the sister franchise to *Military & Aerospace Electronics* in the PennWell Aerospace & Defense Media Group.

What you'll see is not only the best of the content, look, and feel of that you've come to depend on from *Military & Aerospace Electronics*, but also a host of improvements we designed to help you, the reader, navigate the site more easily and more quickly than you can today, get more pertinent content, and find reasons to come back frequently.

One of the biggest changes we made involves topic centers. Today we have a few, and plan to have a lot more in the near future. These topic centers, which today involve embedded computing and Avionics Intelligence content, are designed to give readers a quick snapshot of what's important in their industries.

Click on the gray embedded computing button right underneath the *Military & Aerospace Electronics* logo, for example, and you'll find the ten-or-so most recent stories we've posted on this topic. In the near future, we plan to add stories to enable you to see all stories pertinent to this topic that we have posted in the past year—and beyond.

Now click on the *Avionics Intelligence* button just to the left of the embedded computing button. Here you'll find 100 percent avionics content, ranging from military, to commercial, to business aviation, and general aviation, as well as air traffic control, ground-based communications and everything else avionics—nose to tail, air to ground, and gate to gate.

In the not-too-distant future, we plan to add topic centers such as power electronics, software, design and development tools, integrated circuits, communications, test and

measurement equipment, sensors, and components. If it's important to you, we'll cover it, and make it as quick and easy for you to find as possible.

There's more than topic centers to the new Mil & Aero Website. The navigation bar underneath the home page logo also easily leads readers to our latest content in Webcasts, white papers, the Mil & Aero Command Post online community, the updated buyers guide, and additional content on our site. Look beside the *Military & Aerospace Electronic* logo to find buttons that will lead readers to the Avionics USA and Avionics Europe, as well as the Military & Aerospace Electronics Forum trade shows.

Something else you'll notice about the new site is we don't just want you to be part of the audience; we want you to participate as well. Besides links to the Mil & Aero Command Post online community, the redesigned Mil & Aero home page gives readers a quick glance at the latest Twitter tweets involving *Military & Aerospace Electronics*.

Want your tweet to show up on our home page? Just include the hashtag #milaero, and tweet away. You can see your words of wisdom right on our home page just below and to the right of the Industry News Flash section as you scroll down the page.

Something you might not notice is the amount of content you can browse through on the redesigned *Military & Aerospace Electronics* home page. On the old page, you had a limited number of stories contained in the news, Defense Executive, and Industry News Flash sections. Now you can hit the "more" button to your heart's content to browse from the latest to the oldest stories.

We're particularly proud of the top component of the redesigned home page, which gives readers a rotating look at our most recent exclusive content, which consists of in-depth features, guest viewpoints, question-and-answer interviews, and more.

There are more improvements to come to the *Military & Aerospace Electronics* home page. Stay tuned, and come back often. ●

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NEWS

NASA, industry partner to launch sensor technology on space shuttle flight

By **COURTNEY E. HOWARD**

HAMPTON, Va.—NASA engineers and contractors have worked together for the past two years on a technology to ease the process of docking space vehicles to the International Space Station.

Developed by the Orion Project Office at NASA's Johnson Space Center in Houston, the Vision Navigation Sensor (VNS) coupled with a docking camera can advance the capability necessary for automated rendezvous and docking. The system, which will be tested on STS-134, scheduled for this July, is a part of the Sensor Test for Orion Relative Navigation Risk Mitigation (STORRM) Development Test Objective.

"The VNS is the most advanced relative navigation sensor that has been developed for spaceflight in support of rendezvous and docking," says Howard Hu, manager of Orion vehicle system performance and analysis at Johnson. "The Orion Project is

excited to help NASA advance this technology and looks forward to validating its performance using the space shuttle and the ISS environment."

The first element of that technology—five retro-reflectors designed by NASA Langley Research Center in Hampton, Va.—launched on Space Shuttle mission STS-131 in April. The retro-reflectors are made from reflective material that reflects light back with a minimum scattering of light. They will serve as the targets for the VNS.

The VNS is an eye-safe flash light detection and ranging, or LiDAR, system that provides an image of the target, in this case the space station, along with range and bearing data to precise accuracies. The docking camera is designed to provide high-resolution, color images.

"The sensor provides two to three times more range capability than any other space

Continued on page 8

Microsemi to buy White Electronic Designs to boost expertise in aerospace, defense, and anti-tamper technology

By **JOHN KELLER**

PHOENIX—Microsemi Corp., an Irvine, Calif.-based manufacturer of analog mixed-signal integrated circuits, is acquiring White Electronic Designs Corp. in Phoenix to improve Microsemi's expertise in system-level integrated solutions, anti-tamper technology, and embedded data storage encryption, company officials announced.

Microsemi is offering to buy White Electronic for roughly \$100 million in cash—or \$7 per share. White's technology integrates surface mount technologies, microelectronics, and anti tamper technologies into one solution.

White specializes in integrated circuit

design, assembly, and test integration, with offerings and experience in multichip on-board solutions that are integrated into defense and aerospace applications.

Anti tamper technology enables White's GPS receiver products for munitions programs such as the accelerated precision mortar initiative (APMI) and the Precision Guided Kit (PGK). GPS-enabled precision reduces the 136-meter circular error probable (CEP) of conventional mortars to about 10 meters.

Improving the accuracy of mortars and other battery munitions reduces collateral damage, and enables munitions to destroy

Continued on page 8

IN BRIEF

New wideband radome delivered for F-15 program

A major part of the F-15 Radar Modernization Program (RMP) calls for a new wideband nose radome, which was designed by General Dynamics Armament and Technical Products in Charlotte, N.C. The RMP radome will fly on the U.S. Air Force F-15E as part of the RMP upgrade. Benefits of the radome include superior electrical performance over a wide frequency range, low weight, low part count, and the ability to perform in high heat and stress environments. The radome also includes the installation and integration of an instrument landing system antenna. The SDD contract scope includes radome design, material strength and environmental testing, environmental and structural qualification, tool design, fabrication, assembly, and repair-methods development. Production and program management is being performed at General Dynamics' advanced materials facility in Marion, Va. Ten radomes will be built as part of the SDD phase, with deliveries completed in April 2011.

New avionics computer part of B-2 bomber EHF satcom upgrade

A new integrated processing unit (IPU) that replaces as many as a dozen current stand-alone avionics computers on the B-2 stealth bomber is part of a hardware upgrade that will eventually allow the jet to send and receive battlefield information as much as 100 times faster than its current satellite communications system. Engineers at Lockheed Martin Systems Integration in Owego, N.Y., developed the IPU. The work is being done as part of Increment 1 of the U.S. Air Force's B-2 extremely high frequency (EHF) satellite communications program. Other EHF Increment 1 hardware includes: a new disk drive unit developed by Honeywell Defense and Space Electronic Systems in Plymouth, Minn., that will enable transfer of EHF data onto and off of the B-2; and a network of fiber-optic cable that will support the high-speed data transfers within the aircraft. The three-increment EHF Satcom program is part of an on-going effort by the Air Force and Northrop Grumman to modernize the B-2 to keep it mission capable against evolving enemy threats.

Continued on page 16



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» NEWS

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LiDAR system today,” adds Heather Hinkel, the STORRM principal investigator at Johnson. “Having one sensor that can give high-accuracy navigation information to a crew member, or an automated guidance, navigation, and control system,

from three miles away to within seven feet is unprecedented.”

On shuttle mission STS-134 planned for July, the new system will be demonstrated during docking, undocking, and rendezvous operations. Data will be collected and the crew will be able to monitor the data through a STORRM software

application on the shuttle computer. In addition, screen snapshots of the data will be sent to Mission Control at Johnson by slow scan video for the STORRM team to evaluate the data in real time.

Under direction of the Orion Project office, teams from NASA Langley, NASA Johnson, and industry partners Lockheed Martin and Ball Aerospace worked together in a short time to develop and test the prototype to support the STORRM Development Test Objective.

Engineers at Langley are responsible for engineering management, design, and build of the avionics, DTO computer hardware and reflective elements. They are also responsible for the integration, testing, and certification of these components.

NASA Johnson is responsible for program management, technology evaluation, flight test objectives, operational concepts, contract management, and data post-processing. Industry partners Lockheed Martin Space Systems and Ball Aerospace Technology Corp. are responsible for the design, build, and testing of the VNS and docking camera. ●

Microsemi from page 6


their targets using as few as two shells, White officials say.

“The combination of Microsemi’s and White Electronic’s product portfolios further extends Microsemi’s integrated solution offering in the defense and aerospace markets with technology and capability,” says James J. Peterson, president and chief executive officer of Microsemi. “White Electronic’s chip-level hardware solutions delay or obfuscate chip-level attacks and mitigate reverse engineering and IP theft. This anti-tamper capability is greatly needed today in protecting DOD-critical technologies, and is helpful in enabling foreign military sales.”

The sale is expected to close by the end of June. Microsemi expects that there will be significant cost synergies from the transaction and that Microsemi can drive gross profit levels to its own corporate target as Microsemi exits lower margin business, drives a richer product mix, and realizes operational and other cost synergies by Microsemi’s fourth fiscal quarter.

For more information, contact Microsemi online at www.microsemi.com, or White Electronic Designs at www.whiteedc.com. ●

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Advanced technologies for IED detection and disposal are thrust of Navy research initiative

By **JOHN KELLER**

ARLINGTON, Va.—Scientists at the U.S. Office of Naval Research (ONR) in Arlington, Va., are asking industry to develop and demonstrate advanced technologies to detect and neutralize improvised explosive devices (IEDs) and other kinds of covert explosives on land and under water—including improvised chemical, biological, and nuclear bombs.

ONR experts released a broad agency announcement (BAA 10-015) last month for the Joint Service Explosive Ordnance Disposal (JSEOD) Applied Research Program for advanced IED detection and IED disposal, which initially asks companies to submit white papers on projects that offer potential to improve explosives-disposal operations.

Of particular concern are ideas to develop technologies to detect, identify, and neutralize conventional, chemical, biological, and nuclear IEDs on the ground, buried underground, or hidden under water.

This project includes the potential use and control of robots with dual manipulators, rather than one manipulator as is typical today, as well as modeling and simulation technologies to help train explosives disposal robot controllers and evaluate bomb-disposal capabilities of different robots.

Also of interest are technologies to develop bomb-disposal weapons that enable their operators to use them to destroy IEDs at a safe distance. ONR scientists also are interested in stereolithography

3D imaging and printing technologies.

For underwater IED detection and disposal, ONR experts are emphasizing technologies that use unmanned underwater vehicles. Full proposals are due no later than 9 July 2010.

For technical questions or concerns, contact ONR's Brian Almquist by e-mail at Brian.Almquist@navy.mil.

Business questions should be e-mailed to Sarah Malene at Sarah.Malene@navy.mil. E-mail security questions should be directed to Diana Pacheco at diana.pacheco@navy.mil.

Additional information about this solicitation is available online at https://www.fbo.gov/index?s=opportunity&mode=form&id=08dc1b395b9cb99d3c44e365feda8435&tab=core&_cview=0.



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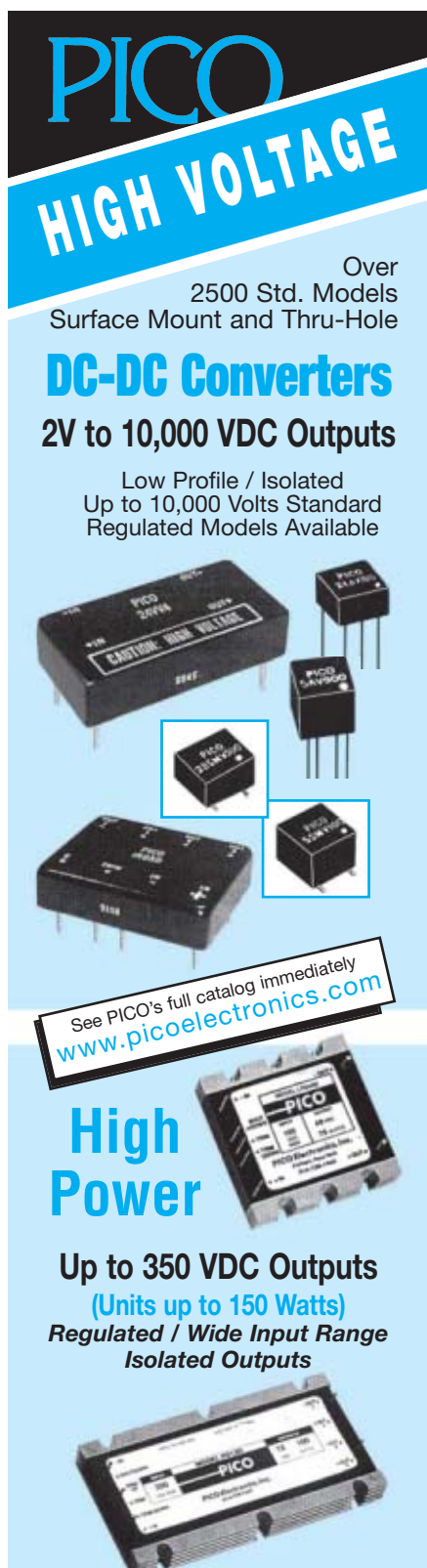
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» NEWS

GE to establish power electronics center of excellence for aircraft, ships, and ground vehicles

By **JOHN KELLER**

DAYTON, Ohio—GE Aviation Systems LLC in Grand Rapids, Mich., is creating a power electronics research center near Dayton, Ohio, to develop electric power technology for more electric aircraft, off-highway hybrid and electric vehicles, and marine applications.

The center will work on advanced electrical power systems research and development in support of hybrid electric ground vehicles, the electrification of naval surface ships and especially in the aviation industry's More Electric Aircraft (MEA) technology.

GE's electrical power technology path supports coming generations of commercial air transports, business and regional jets, and strategic and tactical future programs

such as the ground combat vehicle, the joint light tactical vehicle, unmanned aerial vehicles, and the miniaturization effort of electrical power on naval vessels.

The exact location of the center is to be announced by the end of 2010. GE expects EPISCENTER operations to begin in 2012. The Ohio Third Frontier Commission, which seeks to improve technology research and development in Ohio, is providing a capital grant for up to \$7.6 million in support of the center.

The University of Dayton Research Institute will work with GE to develop and deploy computer modeling, simulation, and analysis of advanced electric power systems design and controls.

For more information, contact GE Aviation online at www.ge.com/aviation. ●

Electronics thermal management firm SprayCool acquired by Parker Hannifin to boost spray cooling expertise

By **JOHN KELLER**

LIBERTY LAKE, Wash.—Aerospace and defense motion and control technologies specialist Parker Hannifin Corp. in Cleveland has acquired SprayCool Inc. in Liberty Lake, Wash., a pioneer of spray liquid cooling for thermal management in military and commercial aviation electronics systems.

Terms of the purchase have not been disclosed. Parker and SprayCool are longtime competitors in the computer cooling business involving spray liquid cooled systems. Electronics cooling is a crucial issue in modern embedded computing to control operating temperatures of high-performance embedded processors. SprayCool operations will become part of the Parker Hannifin Aerospace segment in Irvine, Calif.

The acquisition of SprayCool by Parker

Aerospace will not affect SprayCool's approximately 40 employees at the former SprayCool Liberty Lake facility near Spokane, Wash.

SprayCool began operations in the late 1980s as Isothermal Systems Research (ISR), which changed its name to SprayCool in 2006 to better represent the company's technological expertise. SprayCool has developed enclosed cooling and thermal-management systems for unmanned aerial vehicles (UAVs) and for the U.S. military U-2 high-altitude reconnaissance aircraft.

SprayCool is joining the Parker Aerospace gas turbine fuel systems segment with locations in Mentor, Ohio; Clyde, N.Y.; Glendale, Ariz.; Moncks Corner, S.C.; and Kuala Lumpur, Malaysia.

For more information, contact Parker Hannifin Aerospace online at www.parker.com. ●

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» NEWS

Marine Corps non-lethal weapons to be developed by Metal Storm and General Dynamics

By **JOHN KELLER**

QUANTICO MARINE BASE, Va.—Systems designers at Metal Storm Inc. in

Arlington, Va., and General Dynamics Ordnance and Tactical Systems in Orlando, Fla., are developing prototype

non-lethal weapons for U.S. Marine Corps combat vehicles under terms of research contracts awarded in late April.

General Dynamics and Metal Storm engineers are developing prototypes for the Marine Corps Mission Payload Module-Non-Lethal Weapon Systems (MPM-NLWS) to provide the Marine Corps with improved non-lethal counter-personnel capabilities.


The system is to dispense a new non-lethal munition that will incapacitate personnel through light, sound, and pressure stimuli and will provide longer range, greater area coverage, extended duration, and better scalability of effects than current non-lethal weapon systems, Marine Corps officials say.

Officials of the Marine Corps Systems Command at Quantico Marine Base, Va., awarded a \$3 million contract to General Dynamics and a \$1.5 million contract to Metal Storm to develop prototype MPM-NLWS hardware over the next 18 months.

The new non-lethal weapon system will be mounted to the Marine Corps BAE Systems Transparent Armor Gun Shield (MCTAGS), which is on Medium Tactical Vehicle Replacement (MTVR) units, High Mobility Multipurpose Wheeled Vehicles (HMMWVs), and Logistics Vehicle Systems (LVSS).

The MCTAGS provides gunner protection that enables direct vision, situational awareness, and target acquisition while providing enhanced protection from small arms fire and fragments from roadside bombs.

Transparent Armor Gun Shields (TAGS) also are configurable for other kinds of combat vehicles, including the M2A3 Bradley Fighting Vehicle, M1 Abrams main battle tank, M113 armored personnel carrier, and Stryker. TAGS is particularly effective in close-combat urban military operations.

For more information contact the Marine Corps Systems Command online at www.marcorsyscom.usmc.mil, Metal Storm at www.metalstorm.com, or General Dynamics Ordnance and Tactical Systems at www.gd-ots.com. 

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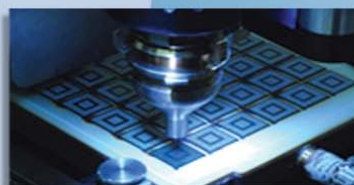
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F-35 avionics: an interview with the Joint Strike Fighter's director of mission systems and software

By **JOHN McHALE**

FORT WORTH, Texas—The F-35 Joint Strike Fighter is a fifth-generation jet fighter that has even more sensors than the F-22 Raptor. The program, led by Lockheed Martin, uses that state-of-the-art avionics with as much commercial off-the-shelf (COTS) hardware and software as possible, says Eric George, director of mission systems and software for the F-35 Joint Strike Fighter program, in the interview below.

George will discuss the F-35 avionics suite in a keynote address to the Military & Aerospace Electronics Forum on 3 June 2010 at the San Diego Convention Center in San Diego. Register



Avionics for the F-35 Lightning II Joint Strike Fighter, shown above, will be covered in the keynote address at the Military & Aerospace Electronics Forum on 3 June 2010 at the San Diego Convention Center in San Diego.

for the event online at www.avionics-usa.com/index/registration-information.html.

Q: What is Lockheed Martin's strategy for integrating COTS electronics throughout the Joint Strike Fighter's avionics?

A: Most COTS electronics within the F-35 occur at the component level; there are no COTS subsystems. At the component level, we make extensive use of military or industrial parts throughout the system. There are few custom ASICs (application specific integrated circuits) or other parts that don't decompose to parts out of the commercial industry. There are, of course, exceptions where the commercial market does not have applications to yield the parts we need. Our use of COTS also extends into

Continued on page 14

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» NEWS

F-35 from page 13

the software arena, where we use COTS operating systems and software development tools.

Q: What is the breakdown between custom electronics vs. COTS electronics in the F-35 avionics systems?

A: I don't know of any breakdown that could be readily generated.

Q: How are you managing obsolescence and life cycle costs in the F-35?

A: We have a process whereby we track our parts for possible obsolescence issues and then evaluate the options that include form, fit, and function (FFF) replacements, redesign, and end of life (EOL) buys. Our system development and demonstration (SDD) program provided for two updates to many of our processors during the SDD phase. This assured that

we exited SDD with processing systems that were not already facing diminished manufacturing sources (DMS) issues. It also allowed us to demonstrate our ability to change this processing without major changes to the software.

Q: Can you describe the unique middleware you designed for use in the avionics systems and how it enables COTS integration?

A: We utilized COTS operating systems, higher-order languages, model-based designs, and proven design patterns that made us less susceptible to changes in the underlying processing or network architecture. Many of the design patterns are codified in standard libraries we utilize across the avionics.

Q: What are some examples of COTS products used in the F-35 cockpit—displays, processors, real-time operating

systems, databases, etc.?

A: Power architecture processors, field-programmable gate arrays (FPGAs), DDR RAM, DDR2 RAM, flash memory, active-matrix liquid crystal displays (AMLCDs), PCI, PCIe, PCI-X, RapidIO, OpenGL, Green Hills Integrity-178 real-time operating system (RTOS), IEEE-1394, Fibre Channel, etc.

Q: Are there different avionics requirements for the different F-35 variants?

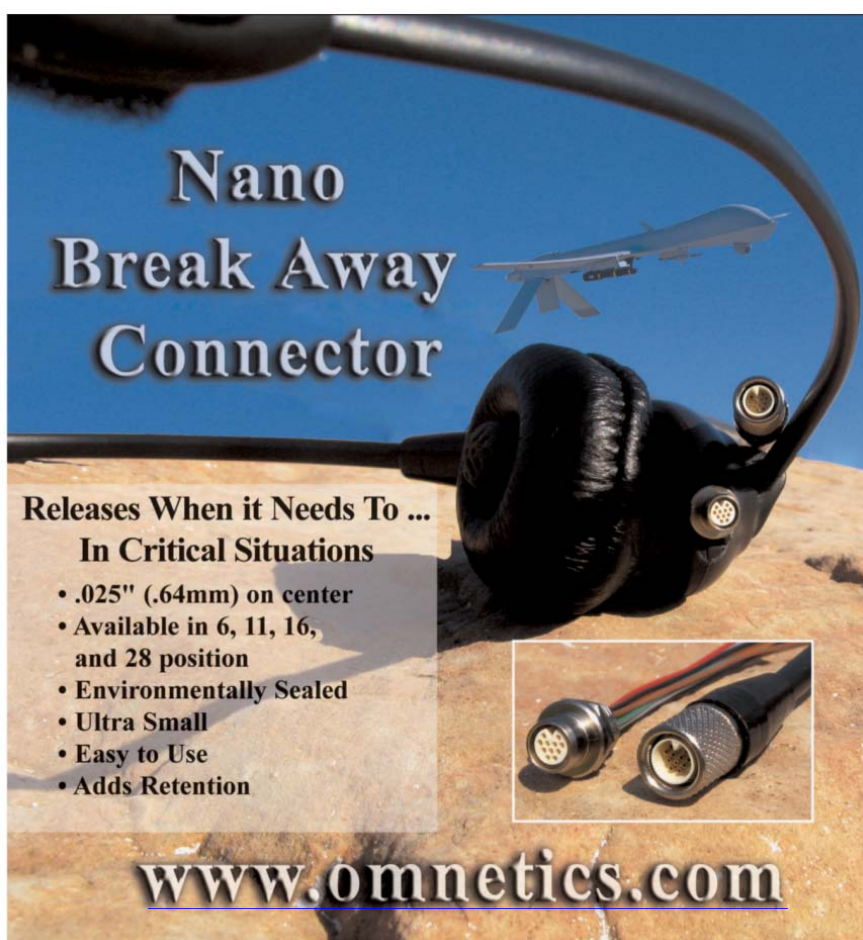
A: F-35 avionics are essentially 100 percent common across all three F-35 variants.

Q: What performance advantages does the F-35 Joint Strike Fighter have over current fighters including the F-22 Raptor?

A: The F-35 is the only stealth multi-role fighter in the world. F-35's very low observable stealth properties enable deep penetration of the most sophisticated air defenses, including those expected to emerge in the 2020 time frame. With a full internal weapons payload (5500+ pounds), the F-35 can fly at Mach 1.6, launch air-to-air weapons at maximum speed, and even launch 2000-pound JDAMS supersonically. The F-35 possesses the most comprehensive and powerful avionics suite of any fighter that has ever flown, providing unprecedented situational awareness, command-and-control, and network-centric warfare capability. The F-35 and F-22 are not competing designs. Each does some things better than the other, by design. The F-35 builds on much of the stealth, aerodynamic, and sensor technology pioneered on the F-22, but the F-35 is a decade newer, and carries more sensors and nearly four times more software code than the F-22.

Q: When is the first F-35 expected to be deployed to U.S. forces?

A: F-35 deliveries will begin in the fourth quarter of this year, with the U.S. Air Force taking initial deliveries of training aircraft for Eglin Air Force Base, Fla. The U.S. Marines are the first service to go operational with F-35s, in 2012. ●



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Version 2 enhancements available for Rockwell Collins Airshow 3D Moving Maps

Rockwell Collins in Cedar Rapids, Iowa, announced that Version 2 software enhancements for its Airshow 4000 Moving Map System for business jets are available and in production. The software features 3D enhancements and adds a modernized look to Rockwell Collins' Airshow 3D Moving Map product lines. The Version 2 software upgrade includes a new graphical design utilizing NASA's Blue Marble map data based on actual satellite imagery. Version 2 supports IP-based connectivity over high-speed and broadband data systems, augmenting existing satellite telephone connectivity, and providing faster, more reliable upload of up-to-the-minute Airshow Network programming. Existing Airshow 4000 customers can upgrade to Version 2 software through a custom software configuration that may require a hardware modification. Software trade-in and performance programs are available for upgrading to Version 2.

Thales wins Watchkeeper support contract

The United Kingdom Ministry of Defense (MOD) awarded Thales UK the initial three-year support contract for the Watchkeeper unmanned aerial vehicle (UAV) program, for which Thales UK is also prime systems integrator. The Watchkeeper support solution will be a performance-based contractor logistics support (CLS) service, providing spares and repairs, technical support and the availability of the Watchkeeper training facility. Thales will deliver this service with the support of its key partners and supply chain, established during the Watchkeeper development and production program. The contract covers the whole Watchkeeper system, comprised of more than 160 entities (including unmanned air vehicles, ground control stations and support vehicles), and includes operator/user training. It is the first step in Thales UK's provision of cost-effective, through-life support to Watchkeeper. The Watchkeeper Service Management Team will be based in the United Kingdom, with Joint MOD/Thales Service Delivery and Training teams based in Abbey Wood, Bristol and

Larkhill, Salisbury, assisted by service support organizations at Thales' facilities in both Leicester and Crawley, England.

FLIR Systems gains \$12.4 million order for multi-sensor systems from U.S. Army

FLIR Systems Inc. in Wilsonville, Ore., won a \$12.4 million order from the U.S. Army for its Star SAFIRE II stabilized multi-sensor systems. The units delivered under this order will be deployed on UH-60 helicopters in support of ongoing Medevac operations. This order adds to the more than 200 Star SAFIRE systems already deployed on UH/HH-60 Medevac helicopters. Work on the delivery order will be completed within the next 12 months in FLIR's Wilsonville, Ore. facility. "This order, a continuation of FLIR's long-term partnership with the U.S. Army on Black Hawk operations, demonstrates the value of our systems to support critical life-saving Medevac missions," says Earl R. Lewis, president and CEO of FLIR. "We take great pride in the development and manufacture of U.S. Army certified and battletested camera systems and are pleased the U.S. Army has once again chosen FLIR products."

Vision processor introduced by Sarnoff for next- generation vision systems

Sarnoff Corp. in Princeton, N.J., is introducing the Acadia II system on a chip (SoC) for real-time, portable, and low-power vision sensor processing. Developed with the support of the Defense Advanced Research Projects Agency (DARPA) in Arlington, Va., Acadia II uses ARM Quad Core processors to enable one SoC to take over the processing functions that in the past required additional systems, company officials say. Acadia II is for portable and wearable vision systems; security and surveillance platforms; manned and unmanned aerial vehicles; unmanned ground vehicles; border and perimeter protection; and vision-aided GPS-denied navigation and guidance. "We can take an entire system and put it within the Acadia II SoC," says Mark Clifton, Sarnoff's acting president and chief executive officer. For more information, contact Sarnoff online at www.sarnoff.com.

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» SPECIAL REPORT

MISSION TO KEEP THE SECRETS



Nine years ago, a U.S. Navy EP-3 reconnaissance aircraft made an unauthorized emergency landing at a Chinese air base on Hainan Island in the People's Republic of China. The stricken electronic intelligence aircraft landed in China after a mid-air collision with a Chinese J-8II jet fighter caused severe damage to the EP-3. While reasons for the incident are in dispute, the so-called "Hainan Island Incident" was perhaps the defining event that brought electronic anti-tamper technology to the forefront of military electronics planning and development.

Protecting secret technology that gives the U.S. and its allies a military advantage, such as on the F-35 Lightning II fighter bomber shown above, is the central thrust of DOD anti-tamper efforts.

The EP-3 is an electronics intelligence (ELINT) aircraft designed to monitor electronic signals from radio communications, cell phones, radar, and other electronic emissions. Like all the rest in the nation's EP-3 fleet, the one involved in the Hainan Island Incident had sensitive information and technology aboard. Despite the crew's attempts to destroy computers, hard disk drives, and other important equipment before landing on

Hainan Island, it is believed that at least some sensitive and/or secret military information fell into the hands of the Chinese government as a result of the emergency landing.

U.S. military pursues anti-tamper technologies to ensure the critical technologies that give the U.S. and its allies a military advantage stay out of the hands of terrorists and potential adversaries.

BY JOHN KELLER

Since that time nearly a decade ago, U.S. military officials have vowed to make it as difficult as possible for foreign nations to obtain sensitive U.S. information and technology resulting from a similar incident ever again. They are doing this with so-called "anti-tamper" technology, which seeks to slow or prevent the unauthorized reverse engineering of U.S. electronic equipment, computers, software, and other critical technologies that give the U.S. and

its allies a military advantage.

Hainan Island Incident

It was the morning of April 1, 2001, as the U.S. EP-3 Aries four-engine turboprop reconnaissance aircraft from U.S. Navy Fleet Air Reconnaissance Squadron One, which was based at Kadena Air Base on Okinawa, Japan, neared the end of a six-hour ELINT mission about 70 miles away from Hainan Island, China. Just after 9 a.m. local time,

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» SPECIAL REPORT



two Chinese J-8 jet fighters from Lingshui air field on Hainan approached the Navy reconnaissance plane.

China says the Navy plane was violating Chinese air space, while U.S. officials say they were operating in international air space. At any rate, one of the Chinese fighters made two close passes beside the slower and

less-maneuverable Navy EP-3, and started a third close pass when the fighter collided with the reconnaissance aircraft, causing the fighter to break apart and crash, and the Navy EP-3 to drop into a steep dive before its pilot regained control of the aircraft.

Although the EP-3's pilot managed to

re-establish level flight, the aircraft sustained serious damage to one of its four propellers, left aileron, and nose-mounted radome, which was ripped completely off the aircraft during the collision.

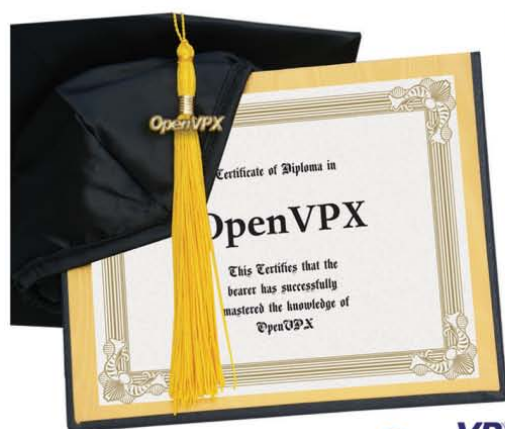
The EP-3 pilot had a tough choice to make: he could order the crew to bail out of the airplane, ditch the damaged aircraft in the sea far from home, or take a chance at landing at the nearest air field, which was Lingshui on Hainan. The Navy pilot, Lt. Shane Osborn, decided to make for Lingshui, but ordered his crew to destroy as much of the airplane's sensitive equipment as possible en-route.

Crew members of the EP-3 reportedly tried to smash computer gear and hard drives with hammers, and even tried pouring coffee into disk drives and computers in attempts to destroy them to keep sensitive information out of Chinese hands. Chinese authorities never granted the Navy plane permission to land at Hainan, which also is the location of a Chinese ballistic missile submarine base. When the stricken plane touched down on the Lingshui runway, it was met by armed Chinese soldiers, who took the plane, the crew, and the onboard equipment into custody.

The crew of the Navy plane was held in China for 10 days. Their aircraft and equipment were dismantled, stripped, closely examined, and ultimately returned to the Navy crated in pieces. Despite the best efforts of the EP-3 crew, Navy officials believe the Chinese were able to gain valuable intelligence data from their examination of the aircraft and its equipment; evidently stronger measures than hammers and hot coffee would be necessary to keep critical information out of the wrong hands.

Anti-tamper technology

Within months of the Hainan Incident, some of the first anti-tamper policy memos started circulating in the U.S. Department of Defense (DOD), and by the next year "it was really starting to pick up," says Jeff Hughes, division chief for the ATSVI Technology Office at Wright-Patterson Air Force Base in Dayton, Ohio. The ATSVI Technology Office originally stood



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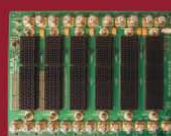
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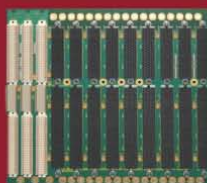
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A U.S. Navy EP-3 Aries similar to this P-3 maritime patrol aircraft was involved in the Hainan Island Incident nine years ago, which perhaps more than any other event gave rise to anti-tamper concerns in the Pentagon.

for Anti-Tamper Software Protection Initiative, yet today its mission has expanded to encompass hardware, as well as software. The ATSVI Technology Of-

fice Web site is at www.at.dod.mil.

The ATSVI office is the DOD's primary technology-development arm for anti-tamper efforts. The ATSVI office is in place to support the DOD's anti-tamper executive agent, which is the U.S. Air Force, Hughes says. It is the ATSVI's job to work with the U.S. military services, with the defense industry, and with academia to develop technology and capability that enables anti-tamper across the DOD—or to prevent, slow, or otherwise discourage the proliferation of U.S.-developed military technologies among terrorists and potential U.S. national adversaries.

"The over-arching issue is we want to enhance our U.S. and coalition capability by making additional exports of defense

technology, and extend the life of coalition warfighting activities," Hughes says. "Sensitive technologies in our weapon systems are called 'critical technology,' or 'critical program information,' and are contained in software and hardware. Anti-tamper is a systems-engineering approach to blending the best possible security and technical controls on critical technologies."

The core of U.S. military anti-tamper policy is contained in DOD Instruction 5200.39, entitled "Critical Program Information Protection within the Department

U.S. military leaders have vowed never to let military secrets fall into the hands of potential adversaries, as happened in 2001 during the Hainan Island Incident and a version of the U.S. Navy P-3, shown at right.



SPECIAL REPORT

of Defense." The latest iteration of DOD Instruction 5200.39 came out in mid-2008, and lays out policy that anti-tamper hardware and software to protect critical military information must be designed into new defense systems and systems upgrades from the beginning.

Critical program information—often referred to as CPI—must be identified early in the technology development, acquisition, and sustainment process, refined at each major stage of development, and tangible steps taken to protect any data or technology

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MUX8508	32	32		■	2	2	300	120	5962-0822601KXC
MUX8510	64	32	32	■	2	4	150	90	5962-0920201KXC
MUX8511	64	64		■	2	4	150	90	5962-0920202KXC
MUX8512	48		48	■	1	3	150	90	5962-0920301KXC
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A U.S. Navy EP-3 reconnaissance plane was nearing the end of an electronic intelligence mission in April 2001 when it was intercepted by, and collided with, a Chinese jet fighter.

Our international partnerships are such that you want to know what's been sold and what capability is out there.

Our anti-tamper efforts are to help slow technology proliferation, and to prevent or slow technology alteration."

Anti-tamper technology can involve friends, as well as adversaries. The U.S. sells much sophisticated military technology each year to allies around the world. While U.S. leaders want this technology in the hands of the nation's friends, they do not want U.S.-developed technology altered or improved in any way they don't know or understand.

"The government wants to know and track exactly what they have sold and given away, and what they haven't," says Tim Teitelbaum, chief executive officer of anti-tamper software specialist GrammarTech Inc. in Ithaca, N.Y. "We want to know exactly what are the capabilities that we are selling." Part



of the anti-tamper game is preventing allies from using U.S.-developed military technology in unauthorized ways. Trap doors or other hidden code, for example, can be inserted into U.S. technology sold overseas to prevent its use in case of a hostile regime change. U.S. officials do not want those trap doors deactivated.

Classified approaches

Due to its sensitive nature, details of anti-tamper technologies largely are classified secret so as not to give away how to keep the secrets. Generally, anti-tamper approaches are designed to keep potential adversaries guessing. "Do you want to have one uniform approach—is there one right answer—or do you want to have different approaches for each system?" Hughes asks. "It really depends on the trade space you are working

that gives the U.S. a military advantage over its adversaries.

"We are in wars, and we lose things in battle," Hughes explains. "We sell things to friends, who sometimes lose things in battle.



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a Chinese J-8II jet fighter like the one shown here damaged a Navy EP-3 aircraft nine years, causing an emergency landing and giving Chinese experts access to sensitive U.S. technology.

in. Both types of solutions exist, and both have a role."

A determined adversary bent on reverse engineering captured technology eventually will find the key for access, most anti-tamper experts believe. Essentially anti-tamper is a cat-and-mouse game where both sides learn from the other's mistakes. For this reason, anti-tamper approaches often are continually changing—in the system's original design, as well as in its periodic upgrades.

"If you look at anti-tamper, the fact that a weapon system uses anti-tamper is not classified, but the kind of anti-tamper is classified," explains Dan Tarantine, executive vice president of White Electronic Designs in Phoenix, which is in process of being acquired by Microsemi. White Electronic Designs specializes in anti-tamper technology for smart munitions guidance.

"We will see a continual evolution of the technology and the lessons learned," Hughes says. "We are not a completely new initiative, but we are still in the formative stages where we bring together and educate a larger and larger number of people. In the life of DOD acquisition, anti-tamper is a fairly new initiative; it's still a work in progress."

There are things we can do to prevent unauthorized access into a system. If you look at anti-tamper, the fact that a weapon system uses anti-tamper is not classified, but the kind of anti-tamper is classified.

Anti-tamper software

Anti-tamper technology can be applied to software, as well as hardware—and sometimes the best anti-tamper approaches involve both. "There is a whole procedure in how you identify the critical things that must be protected, and it is across the board," explains GrammaTech's Teitelbaum. "What are the key algorithms, and other parts, that give us a key advantage—and the parts that we don't want monkeyed with? It's a very, very hard problem."

GrammaTech software engineers are experts in the manipulation of software source code and binary code to enable reverse engineering, as well as to prevent reverse engineering. "Some of our solutions involve looking at the source code and recompiling, while other solutions add protection to that,"

Teitelbaum says.

Some software approaches to anti-tamper can involve a simplistic binary code rewriting, which is like a software patch. "The binary code remains pretty much unchanged—except for that patch," Teitelbaum says. "One alteration

you might do is to cut out parts of the code from the CPU program executable, put them in an FPGA, and modify the code so it interacts with that FPGA."

In this way, systems engineers might isolate certain crucial parts of the code from the main program software. "In a network attack, the attacker might not even know the

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FPGA is there,” Teitelbaum explains. Another software approach involves software obfuscation—making the code hard to understand. Still, ultimately the program has to run—and it has to run unscrambled.

Even though pure software-obfuscation approaches are limited, they still have a role in anti-tamper because obfuscation “slows people down a little bit,” Teitelbaum says. “There is really no perfect solution here, but we have to consider how long



The EP-3 Aries reconnaissance aircraft like the one shown above, was confiscated, stripped, and examined during the Hainan Island Incident to gather sensitive intelligence on U.S. systems.

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would it take for people to crack it.”

More elegant software anti-tamper approaches involve a technique called “melt, stir, refreeze,” which involves a radical alteration of software code. “Melt is to reverse engineer the executable,” Teitelbaum explains. “We think of an executable as an ice cube; everything is locked in there. We can reverse engineer it into a representation that is like a fluid. The stir is the modifications; once you have the thawed representation, you can do the stir anyway you want, and then refreeze it into another executable. If the stirring involves excising critical pieces of the software, then you have removed the things you don’t want the attackers to see. You need to put those components somewhere else. At least if you felt the critical algorithm in the CPU program was risky, then pulling it out eliminates that risk.”

Another anti-tamper approach to software can involve using an interpreter, which is a similar approach to Java machine code. “This involves replacing the machine code with an interpreter and byte codes,” Teitelbaum says. “Pervasive rewriting could enable you to use interpreter code; you could excise the code from the machine instructions and put it in byte codes.”

Once anti-tamper experts have an approach that works well, they must take care to keep it secret, Teitelbaum warns. If you have a great solution, maybe you don’t want to use it in every system, and save it for the crown jewels. An environment for doing many different things is advantageous. This is an arms race; every offense has its defense.”

Anti-tamper hardware

Anti-tamper approaches that involve hardware can range from placing crucial software code in FPGAs to physically destroying crucial components through explosions or large jolts of electricity. “What we will do is destroy the microcircuit before they get to the algorithms,” says Tarantini of White Electronic Designs.

“It can be a physical destruct with

SPECIAL REPORT

protective coating; it can be a serpentine mesh where they actually break the current going to the mesh; it could be a diode that triggers on X-ray, so X-raying the device causes an event to happen. I can have a diode that will count the radiation and once it reaches a certain level may use a pyrotechnic event to blow the chip up.”

White Electronic Designs specializes in circuitry that provides GPS-based smart munitions guidance to mortar rounds and other battlefield munitions. Anti-tamper is particularly important in this line of business. “In these guided munitions, we launch them, they communicate with satellites, and if they are in the range of the GPS coordinates to the target, they charge a capacitor and the munition detonates,” Tarantine explains. “If the munition is outside of the GPS targeting coordinates, however, we don’t want it to explode because it can cause collateral damage. The bad guy wants to get the munition, take it apart, and try to get to the encrypted algorithms.”

Anti-tamper technology is not for the

casual practitioner, Tarantine warns. “There really are only a few of us in the world that do what we do,” he says. “The barrier for entry is quite high. You need a secure facility, a communications security account through the NAS, cleared employees, and to build the equipment and write the software yourself.”

Some suppliers of electronics equipment do not supply the anti-tamper technology, but design their components to facilitate the insertion of anti-tamper means at a later time. “We provide an FPGA that enables our customers who are providing a systems solution to implement their own strategy for anti-tamper,” says Aaron Lindner, engineering manager for embedded computing specialist Extreme Engineering Solutions (X-ES) in Middleton, Wis. “Voltage monitoring we provide enables the customer to react to any tampering. How the FPGA reacts to its external interfaces that leave the card is controlled by the FPGA. Any problems they detect, they can prevent those interfaces from leaving the card. We have anything that is not on volatile memory traverse through the FPGA so

customers can write their own code before it goes to the CPU.”

Anti-tamper and COTS

Much anti-tamper technology that exists today is custom-developed, and one challenge of this arena is to blend anti-tamper capability with commercial off-the-shelf (COTS) hardware and software. One company at the forefront of COTS and anti-tamper is Curtiss-Wright Controls Embedded Computing in Leesburg, Va.

“We are bringing anti-tamper enabling technologies into our products and into the market for our customers to leverage the COTS proposition to save them time and money,” says Joey Sevin, business development manager, Curtiss Wright. The Curtiss-Wright Trusted COTS initiative has three components.

The importance of anti-tamper technology in mil-aero systems cannot be taken lightly, Sevin says. “It is a problem that has to be resolved. Everyone is putting a lot of effort into it. The whole industry is stepping forward.”



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TECHNOLOGY FOCUS

Power is paramount

Warfighters in the field rely on novel power electronics to drive mission-critical systems.

By **COURTNEY E. HOWARD**

The U.S. military is reportedly the single largest consumer of energy in the world. In fact, according to the U.S. Department of Defense's (DOD's) FY2008 Annual Energy Management Report, the DOD's total primary energy consumption for the year was 1,138 trillion BTUs (British thermal units). The DOD also spent a record \$20 billion for energy in FY2008. Power is an important concern for not only the DOD, but also each and every deployed soldier.

In military and aerospace environments, constant demand exists for ever-higher power density: greater performance and efficiency in a smaller size, as well as cost reduction and enhanced reliability, says Fred Lewis, director of sales and marketing at Martek Power in Torrance, Calif. As a whole, the mil-aero industry is moving into green technology, higher power densities, increased requirements, and a shift from full mil-spec to commercial off-the-shelf (COTS) or commercially available components; yet, he explains, size and weight are among the biggest drivers of power electronics designs today.

Combat vehicles

More power in a smaller package, or higher power density, is the direction in which

power electronics is always moving, says Brad Dolbin, technical product manager of motion control and power electronics at Curtiss-Wright Controls Electronic Systems in Santa Clarita, Calif.

"The biggest trend is toward more electrification in vehicles, including more automation in some vehicles," Dolbin mentions. "The power requirements in older vehicles were quite minimal; today, lots of hydraulics are being replaced with electronics, driving the need for more power electronics. Existing platforms are being modernized with more electronics, and virtually all the new platforms have a much higher content of power electronics."

Many new platforms capitalize on power electronics technology developed originally for the Future Combat Systems (FCS) program. The U.S. Army's Brigade Combat Team Ground Combat Vehicle (GCV) may employ servo motor controllers (SMCs) that were developed by Curtiss-Wright Controls Electronic Systems for all the vehicles in FCS program, for example.

Servo motor controllers are used for several different functions, such as to drive the turret and turret positioning,



Curtiss-Wright Controls Electronic Systems servo motor controllers serve several functions in combat vehicles, such as to drive the turret and turret positioning, the ammunition handling system, and fans and pumps.

the ammunition handling system, and fans and pumps throughout the vehicle, as well as to open doors and hatches automatically. "This motor control technology is being leveraged by many post-FCS programs for use in newer vehicles to drive virtually anything that requires a motor," Dolbin adds.

The new SMCs received testing in prototype vehicles for the FCS program, particularly the Non-Line-of-Sight Cannon (NLOS-C), the lead vehicle in terms of schedule for the FCS program. Curtiss-Wright SMCs are part of the ammunition handling system, turret drive system, fans, and pumps throughout the vehicle.

New combat vehicles increasingly are tapping high-voltage technology, requiring a slightly different power electronics approach. "Typically, the lower-voltage (28-volt) components are a metal oxide semiconductor field effect transistor (MOSFET) technology, whereas the higher-voltage (610-volt) parts are insulated gate bipolar transistors (IGBTs)," Dolbin explains.



Curtiss-Wright Controls Electronic Systems servo motor controllers were tested in prototype vehicles for the FCS program, particularly the Non-Line-of-Sight Cannon (NLOS-C), shown here.

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"The benefit is higher power density, greater power transfer, and better efficiency."

This trend of infusing combat vehicles with more and more vetronics will continue into the foreseeable future. "There will be more automation in a vehicle and more power requirements, so there will be substantially more power electronics in a vehicle," Dolbin predicts. "Power electronics are evolutionary: there are constant new releases in power devices and control devices associated with power electronics."

Lead-acid to lithium

Embedded in combat and light tactical vehicles are batteries used to independently power devices such as fire suppression systems or actuators to raise or lower a door. These systems traditionally have been powered by lead-acid batteries, but recent applications use lithium iron phosphate batteries, explains Jeff VanZwol, marketing director at Micro Power Electronics in Beaverton, Ore.

Micro Power designs and manufactures custom battery packs for different types of military applications; to date, the company has largely designed battery packs for handheld radios, handheld GPS receivers, and other land warrior applications. Today, however, many mobile applications that have traditionally used lead-acid or flooded lead-acid batteries now use a new type of lithium battery technology.

"The specific battery technology is lithium iron phosphate," VanZwol says. What differentiates lithium

iron phosphate from lithium cobalt oxide, the material in the cells powering essentially every notebook computer and cell phone, is a very high rate capability; it can deliver a lot of current and it also works at a wider temperature range. This new flavor of lithium cells enables Micro Power to build a lead-acid battery equivalent that is slightly smaller than and, more importantly, half the weight of comparable technologies. The battery pack is also safer and not susceptible to venting or leaking, which is common with lead-acid batteries.

"These days, the DOD is trying to light up all types of mobile applications—whether carried by the soldier or transported in a vehicle," VanZwol adds. "So, the trend for us in the power electronics space is where traditional lead-acid batteries, like car batteries, are being replaced with lithium-based batteries, which are a lot lighter."

Over the next year, VanZwol anticipates improvements in overall battery capacity and increased demand for lithium iron phosphate technology, as more original equipment manufacturers (OEMs) seek alternatives to lead acid.

Managing power

Power management systems are gaining as much DOD attention as power supplies. The U.S. Marine Corps, in fact, is scheduled to test and evaluate vehicle power management systems this summer. The goal is to improve Marine Corps mission effectiveness by increasing the electric power available to ground forces.

The BAE Systems Platform Solutions Sector in Johnson City, N.Y.,

won a contract to develop an on-board vehicle power management system. The contract award is part of the Marine Corps Onboard Vehicle Power program, funded by the 2009 American Recovery and Reinvestment Act.

BAE Systems engineers designed a system that will more than triple the electric power output of the High



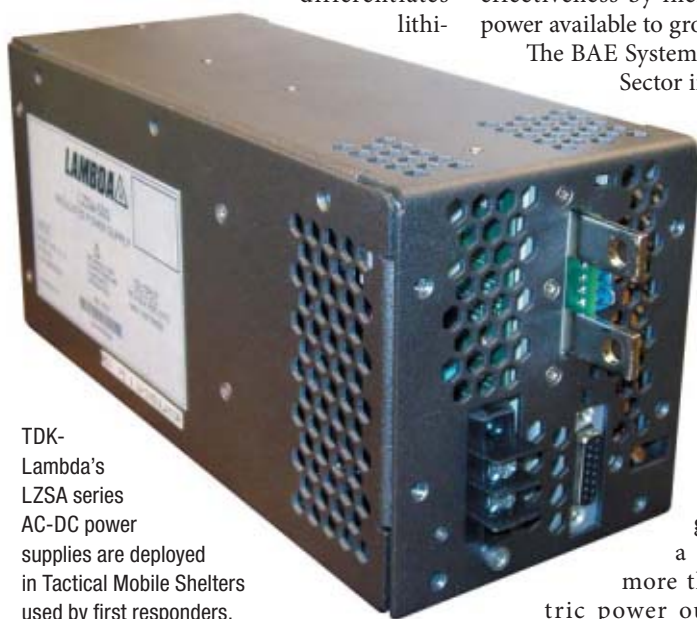
Vicor's V-I Chip, delivering DC-DC conversion and 28-volt DC input in a rugged, miniature package, is well suited to ground vehicle and airborne applications.

Mobility Multipurpose Wheeled Vehicle (HMMWV), and provide exportable power to support such facilities as forward-deployed command centers and field hospitals. It is also capable of providing mobile emergency power during natural disasters. Marine Corps leaders, after evaluating systems from two suppliers, plan to award a contract for five to 10 additional systems later this year.

"BAE Systems recognizes the need for more electricity to power the equipment of the modern military," says Marion Van Fosson, general manager of military vehicle systems for BAE Systems. "Our system supports the Marine Corps commitment to develop and field new solutions that reduce energy consumption and dependence on fossil fuels. Most importantly, the technology will help improve mission effectiveness."

BAE Systems engineers will perform vehicle integration work on a government-furnished HMMWV, expanding its power generation capability to 30 kilowatts of continuous, mobile, onboard power to support Marine Corps expeditionary units.

The integrated system generates and manages power for use on the vehicle and as an exportable power source, eliminating the need for towed generators and improving the HMMWV's mobility. The solution further manages electrified



TDK-Lambda's LZSA series AC-DC power supplies are deployed in Tactical Mobile Shelters used by first responders.



accessory systems, such as water pumps, engine fans, power steering pumps, and air conditioning.

BAE Systems' onboard power management system is employed on U.S. military Paladin Integrated Management vehicles.

First response

Other military vehicle applications are increasingly adopting power electronics based on commercial off-the-shelf components. Engineers at TDK-Lambda Americas Inc. in San Diego produce custom power supplies based on COTS power modules for military use. TDK-Lambda has launched a series of power modules that combine AC-DC and DC-DC converters into a one-module solution, enabling a size reduction of 25 percent.

The company's LZSA series of AC-DC power supplies have been deployed in Tactical Mobile Shelters used by first



The dB-3758 from dB Control synchronizes the power supply switching frequency with a radar system clock and blanks during the pulse, making it well suited for low phase noise radar transmitter applications.

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responders. "The LZSA, a true COTS power supply, was chosen because of its rugged shock and vibration specifications and wide operating temperature range," says David Norton, vice president of marketing and technical support at TDK-Lambda.

"We are seeing a desire for convection- or conduction-cooled power supplies,"

Norton adds. The company, focused on extending its range of true COTS products, will be launching a series of conduction-cooled products this summer.

Underwater and airborne

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The dB-4118 microwave power module from dB Control is designed for manned and unmanned airborne applications, such as electronic warfare threat simulation, electronic countermeasures, and multi-mode synthetic aperture radars.

conversion systems for a variety of mil-aero applications. Its V-I Chip, offering DC-DC conversion and 28-volt DC input in a rugged, miniature package, is suited to various ground vehicle and airborne applications. One unique customer, however, adopted the component for an underwater active sonar system.

Active sonar can detect submarines that are too quiet to be located with passive sonar, and large marine mammals in high sound pressure zones such as those used for military exercises. A Vicor customer, specializing in the rapid prototyping of harsh-environment instrumentation and ocean-acoustic research for diverse commercial and government programs, used Vicor's V-I Chip to develop an enhanced active sonar system for harbor defense.

The sonar system, an underwater cylinder with attached hydrophone transducers, transmits a signal and receives a reflected signal in response. Incoming signals are interpreted to identify the object or intruder, whether a swimmer, whale, or underwater vehicle.

The sonar system's design required a solution offering high reliability, small size, low noise, 1 kilowatt of power, and low heat dissipation. Vicor's V-I Chip met these requirements, while another Vicor product met those of a military helicopter-borne laser diode countermeasure system.

The two parts of an electro-optic countermeasure system for Army helicopters—the command-and-control board and the laser diode driver board—employ Vicor's MIL-COTS VIPAC modular power systems. The one command-and-control card

per system uses a VIPAC with three modules: a 15-, 5-, and 24-volt brick. The laser driver card, two in each system for redundancy, uses a VIPAC with one 24-volt brick and a VIPAC with one 15-volt brick.

UAV power needs

Delivering X- and Ku-band traveling wave tube amplifiers (TWTAs), microwave power modules (MPMs), and high-voltage power supplies (HVPSSs) for manned and unmanned airborne applications is the focus of dB Control in Fremont, Calif. Its power electronics solutions power radar and communications systems integrated on platforms such as the MQ-9A Reaper, Predator B, I-GNAT, RQ-MQ-8A Fire Scout, RQ-4A/B Global Hawk, and MQ-1C Sky Warrior unmanned aerial vehicles (UAVs), in addition to the C-12/U-21 KingAir 200, and EH-60 Black Hawk manned aircraft.

Specifically, power amplifiers from dB Control are employed in Lynx SAR/GMTI radar systems, used by many unmanned aerial vehicles (UAVs) to transmit near-real-time, full-motion images of objects on the ground. The system captures images from up to 16 miles above, in total darkness, through clouds and rain.

The company has introduced two microwave power modules—the dB-4118 and dB-3758—designed for manned and unmanned airborne applications, such as electronic warfare threat simulation, electronic countermeasures (ECM), and

multi-mode synthetic aperture radars (SARs). The dB-3758 synchronizes the power supply switching frequency with a radar system clock and blanks during the pulse, ensuring that no signal is lost and making the MPM well suited for extremely low phase noise radar transmitter applications.

TWTAs from dB Control currently serve as transponder amplifiers in satellites requiring Ku-band and higher frequencies. According to says Joe Hajduk, chief executive officer at dB Control, efficiency and reliability are of paramount importance for such applications. "The TWTAs ratio of RF (radio-frequency) output power to prime power input (real efficiency) is now greater than 60 percent and will soon reach 70 percent. Considering that TWTs have operating lives greater than 20 years, I believe they will continue to be the best choice for providing uninterrupted service in communication and radar applications."

Military organizations, such as the U.S. Air Force, are now recommending the development of extremely high-altitude airships (HAA). "This bodes well for power electronics such as dB Control's traveling wave tube power amplifiers and microwave power modules, which can operate reliably under the extreme conditions (such as pressure, vibration, temperature) experienced at high altitudes," Hajduk says.

"Over the next decade, traveling wave tube power amplifiers will continue to be



Martek Power's MW400S 400-watt, single-output, AC-DC power module is targeted at military, industrial, and aerospace applications.

TECHNOLOGY FOCUS



Martek Power's PF100 active power factor correction and harmonic attenuation module with 100-watt output power is a COTS unit designed for military and aerospace applications.

the amplification device of choice for a broad range of defense systems with RF power outputs up to 2.5-kilowatt continuous wave and 25-kilowatt pulse at frequencies up to 95 GHz," Hajduk predicts. "No single solid-state amplifier can deliver this level of peak-to-average power and bandwidth."

At the same time, power supplies will need to be lighter and more compact, Hajduk explains. "To meet these critical requirements, TWTAs in a power-combined configuration must be developed for each frequency band. These TWTs can then be combined with solid-state amplifiers to produce smaller, lighter MPMs."

DC to AC

Martek Power's Lewis notes a shift from DC to AC power distribution within the mil-aero industry. To meet this demand, the company developed its MW400 series 400-watt, single-output, off-the-shelf AC-DC power module. "We're seeing a desire for more power—not just in the military, but across the board," he says. "Everybody wants more for less in a smaller space."

The company's MW400 power offering and its PF series of active power factor correction and harmonic attenuation modules, originally designed for Air Force applications in conjunction with the engineering team at Martek France, are being employed in both new and old mil-aero platforms.

"We still have products that have been selling for 40 years on longtime programs," Lewis explains. Martek products also are making their way onto "new platforms and in a lot of upgrades in which they are

adding equipment." The company won a contract last year with General Dynamics Canada (GD Canada) in Ottawa for work on airborne warning and control system (AWACS) aircraft for the North Atlantic Treaty Organization (NATO). GD Canada engineers upgraded monitors on the aircraft and employed a semi-custom power electronics system from Martek Power.

Rad-hard in space

Power efficiency and increased functionality in lighter and smaller solutions, as well as reliability under extreme conditions continue to be key drivers in mil-aero, observes Fred J. Farris Jr., vice president sales and marketing in the HiRel Business Unit of International Rectifier (IR) in El Segundo, Calif. "Solutions are more integrated, reducing size, weight, resistance, and inductances. The trend is toward affordable and sustainable sources of supply, high reliability, and improved performance."

In space applications, Farris notes

another trend: replacing mechanical relays with solid-state relays (SSRs). IR offers radiation-hardened (rad-hard) SSRs for power bus switching, heater control circuits, and battery charging in high-reliability (hi-rel), space-qualified applications.

The company's RDHA701CD10A2N and RDHA710FR10A1N rad-hard DC single-pole, single-throw-type SSRs are designed to replace traditional electro-mechanical relays that are vulnerable to vibration and shock. IR also supplies hi-rel DC-DC converters to industry firms such as EADS Astrium in the United Kingdom.

"IR will continue to invest in research and development to provide innovative power technology—from discrete semiconductors and integrated circuits to hybrids and fully integrated power systems for high-reliability markets, including space, military, heavy-duty industrial, and medical," Farris mentions. More to the point, just last month, the company opened a new 35,000 square-foot facility—which is

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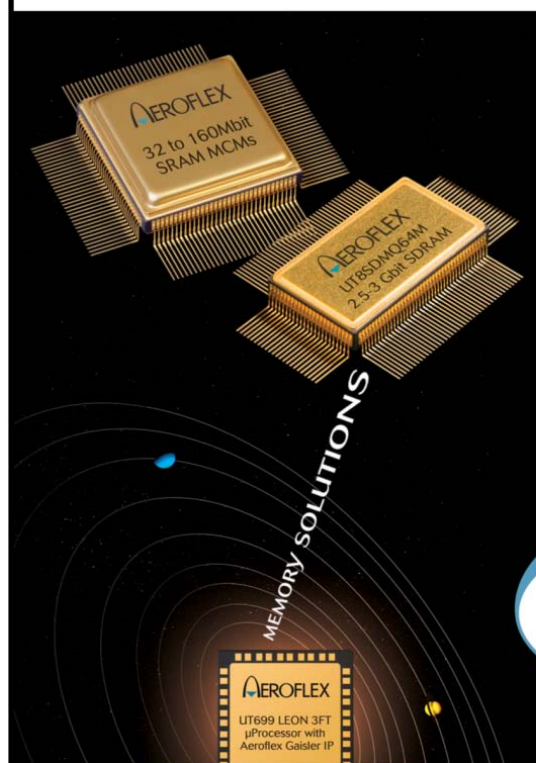
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DSCC-certified Class H and Class K, and AS9100- and ISO9001-qualified—to design and manufacture ruggedized hybrid DC-DC converters for customers of IR's HiRel Business Unit. "IR's new San Jose facility underlines our commitment and investment in ongoing R&D, enhanced design, and world-class manufacturing to deliver high-performance solutions and to be the vendor of choice for our customers," he says.

Hi-rel avionics

"We continue to see the influence of lower-voltage processors driving our customer base, which includes a broad base of worldwide designers in the high-reliability avionics, military, and space markets, to develop power conversion designs that are extremely efficient, of a small size, and cost effective," notes Michael J. Bosmann, senior vice president of sales and marketing at VPT Inc. in Everett, Wash. To meet these challenging design demands and the high-reliability and performance needs of these markets, the company offers power electronics solutions such as its DVPL point-of-load (POL) converter. Reportedly the only MIL-PRF-38534 Class H-qualified product of its kind, the hermetic, hi-rel converter is designed to address low-voltage, reliability, performance, and cost concerns.

VPT's power conversion devices have been employed in high-reliability applications in more than 25 countries. Its power

electronics have been adopted by the GPS II Satellite program, several NASA and ESA (European Space Agency) projects, Japan's new P-1 aircraft, and the F-35 fighter jet.

For high-reliability commercial avionics and military applications, VPT boasts a line of hermetic devices qualified to MIL-PRF-38534 Class H. Hybrid micro-electronic solutions can be cost prohibitive, so the VPT series combines most of the proven topologies and design approaches used in the hybrid devices with lower cost, automated SMT (surface mount technology) assembly, and non-hermetic packaging to meet the cost goals of many projects—such as ground applications, military vehicles, and non-flight critical avionics systems. VPT has also expanded its line of radiation-tolerant and radiation-hardened products for the space market with a new 100K RAD TID point-of-load converter.

"Designers are requesting slightly different voltages to power their systems today," Bosmann continues. "In the past, 5V,

its approach to serving the power conversion electronics needs for the mil-aero applications of the future," advises Bosmann. "Our research and development in process technology is focused on improving performance and reducing cost, whether in material, process time, or both. The one constant in this market, however, is always high reliability. Improving reliability is paramount to everything we've done in the past and will do in the future."

Saving time and money

"It may seem like a difficult goal at times," Bosmann says, "but I have always believed that shortening time to market and reducing costs while improving performance are the driving forces in all markets."

Keith Nardone, director of business development, Aerospace-Defense, Vicor, agrees. "I would say the industry trend is toward reducing development time and cost, while improving total system performance."

In the future, size, weight, and power (SwaP) will continue to be key features that end users and power electronics suppliers continually seek to optimize. Nardone says, "I expect system designers to continue to pack more electronics into smaller places, which will carry on the challenge to the power industry to develop leading-edge products to meet these difficult environments."

Systems designers and integrators will also seek out components or complete power systems with configuration flexibility, such as a wide selection of input and output voltages, power levels, and mechanical options, as well as high efficiency, low noise, ease of use, and high reliability, Nardone explains. Finally, he says, "budgets will continue

to be squeezed over time and companies will be tasked to do more with less. It may force system designers to rely more on the power industry to provide complete power solutions, but without the high cost of a typical new development item (NDI)."

Whatever challenges lie ahead, providers of power electronics, systems developers and integrators, and warfighters will meet them head-on and powerfully. ●



VPT has added several new output voltages to existing product lines to meet the trends of specific voltages for newer military and avionics systems.

12V, and 15V were the voltages required by most systems. Today, designers are frequently requesting voltages of 6.3V, 7V, 8V, 9.5V, 18V, and others. In some cases, they are allowing for the diode drop or similar drop by utilizing slightly higher voltages. As a result, VPT is adding additional output modules to many of its most popular families of DC-DC converters.

"A company needs to remain flexible in

OPINION

Do you copy?

COTS tools reduce downtime and aid network-centric operations.

By **ASIF NASEEM**

Military and aerospace developers continue rapidly to adopt commercial off-the-shelf (COTS) solutions as they evolve to next-generation network infrastructures. While key requirements, including tolerance of shock, vibration, extreme temperatures, and environmental hazards, will remain integral components to any military and aerospace request for proposal (RFP), another element that is becoming increasingly critical to network-centric operations is service availability.

In its essence, service availability implies a service is always available—regardless of hardware, software, or user fault—and it is often taken for granted until an outage occurs. Original equipment manufacturers (OEMs) know that uninterrupted service is crucial to the deployment of military and aerospace applications, and equally as important to the costs of fixing a down network after deployment.

In short, when service goes down, costs and risks go up. Perhaps the most dramatic examples of the costs and risks of downtime are the Federal Aviation Administration (FAA) National Aerospace Data Interchange Network (NADIN) system outages over the past two years. The system tracks more than 1.5 million flight schedules each day for all commercial jetliner domestic departures and arrivals. On November 19 of last year, a software-configuration problem with a network router caused an outage of the 24-year-old system, causing flight delays of several hours for airline passengers across the country.

Another NADIN incident in August 2008 resulted in downtime and delays of two hours or more at more than 100 airports. In 2007, meanwhile, a network

outage grounded flights across the country for nearly six hours. Subsequently, NADIN experienced three separate major service outages that caused two to six hour flight delays throughout the United States. The most surprising—and disturbing—aspect of these incidents is that the FAA was not able to trace the cause of the problem.

The FAA's serious problems with NADIN highlight just how crucial service



availability has become in the daily operations for systems of every type. Further, the unpredictable and unclear causes of the problems reveal the need for a transparent and reliable approach to service availability that eliminates the outages.

By integrating technology solutions that enable five nines (99.999 percent, or five minutes and 15 seconds of downtime per year) service availability into military and aerospace applications, downtime can be combated, seamless connectivity can be ensured, and costs and risks can be minimized. To that end, an ecosystem of COTS suppliers is emerging, providing industry-standard building blocks and systems that can be employed in mil-

itary and aerospace applications to ensure high service availability. For example, at the beginning of 2010, GoAhead Software announced partnering with Global Technical Systems (GTS) and Northrop Grumman (NGC) to support the Navy's Common Processing System program. The system's foundation is based on service availability specifications and integrates GoAhead's solution, SAFfire, ensuring continuous service of warfighter systems without loss of service or data.

Just like the Navy did several years before, the FAA is now working to better understand the service availability problems within their network. Their Data Communications program initiative focuses on delivering a new generation of capabilities and eliminating outages.

When completed, it will enable air-traffic controllers and pilots to communicate with greater capacity and reliability. This system is intended to remove as much human error as possible by replacing labor-intensive voice communication.

Early indications from the FAA are that open architecture principles will be embraced in the new system. For the FAA, this means that the new system will likely include major COTS platforms and follow the guidelines and specifications from organizations such as the SA Forum.

Network-centric operations continue to evolve, and with this migration to next-generation networks comes a myriad of outages occurring across diverse applications. It is expected that five 9's service availability—and higher—integration into military and aerospace COTS solutions will continue to grow. The resulting enhancement of system transparency and reliability will eliminate the dramatic outages and confusion about their causes. ●

Asif Naseem is president of the Service Availability Forum in Beaverton, Ore. The SA Forum consists of component and board manufacturers to service providers and operators. Contact the SA Forum online at www.saforum.org.



PRODUCT INTELLIGENCE

Military avionics displays embrace commercial technology, but ruggedization challenges remain

By **JOHN McHALE**

Designers of avionics displays are using new commercial technology, such as LED (light emitting diode) and active-matrix organic light-emitting diode (AMOLED), for military aircraft cockpits, yet they experience challenges in ruggedizing the devices for extreme environments.

Mature technologies such as liquid crystal displays (LCDs) are “very mature and barriers to entry are low—with lots of new players saturating the market,” says Gregory Walters, marketing manager of crew interface products at Honeywell Aerospace in Phoenix. “However, technological differentiators still exist in LED backlighting; lower cost, lower power consumption, higher reliability (almost 10 times), redundancy: no single bulb failure can shutdown the backlight.

“Sequential backlighting is next on the horizon—only illuminating those LEDs that you need—providing even lower power,” Walters adds.

Another trend among military avionics integrators “is the use of large area displays with night-vision imaging system (NVIS) touch screens in fighter cockpits,” says Tim Cantrell, vice president of Avionics North America at Barco in Rancho Cordova, Calif. “We offer the only NVIS-compliant infrared touch screen. The IR technology

does not degrade the optical performance of the display.”

“AMOLED is the disruptive technology—low volume, low power, no backlight needed, flexible for conformal display surfaces,” Walters says. “However, it is still three to five years before they are rugged enough for military applications. Also nothing very large has been fielded yet (4 or 5 inches is the current size with nothing close to 15 inches).”

The primary application for AMOLED technology is cell phone usage right now, Walters adds.

In the meantime Walters says avionics integrators want high luminance (brightness); no reflective glare especially for bubble canopies; low power consumption; high reliability; reduced line replaceable unit (LRU) size to make a flat-panel display actually flat; obsolescence mitigation; plug-and-play integration; intuitive information displayed for reduced pilot workload; significant data processing and sharing so operators can know where the bad guys are; and touch screen drag and zoom capability with gloves on.

All the new technology is exciting but ruggedization headaches remain.

“It is more difficult to harden a display today because of the shrinking avionics and

defense market in relation to the civilian market,” says Jim Zentner, manager of business development at Astronautics in Milwaukee. “Military hardware does not drive innovation as much as the commercial realm and does not dictate the environmental or electromagnetic interference (EMI) requirements that today’s electronic components are built to. Getting components that can be used in these applications is becoming more of a challenge as the iPod world takes over.”

Astronautics’ latest display is a civil and military certified 6-by-8-inch multifunction color display (MFCD), Zentner says. It uses LED NVIS-compliant backlight, accepts video inputs (via RS-170), and has a 1.3-GHz Intel Atom processor with aircraft interfaces and bezels available. It is also certified to the DO-160F standard for civil avionics certification, he adds.

The rugged mil-spec monitor (MSM) series from Digital Systems Engineering (DSE) are on such Air Force programs as B-52 bomber. The display is designed to operate under the extreme environments found in high-performance jet aircraft, off-road and tracked vehicles, unmanned aerial vehicle (UAV) applications, marine, and submarine vessels. DSE’s displays are housed in an IP67/NEMA 6P sealed, milled billet aluminum enclosure. It is light weight and watertight, with sealed, military-grade connectors.

Boeing officials selected the DuraVIS 3006 and DuraVIS 4300 from Parvus in Salt Lake City to serve as the flight test display (FTD) and the instrumentation crew station control panel (ICCP), respectively, for the P-8A Poseidon maritime patrol aircraft. T

The display system is a combination of the Parvus DuraCOR mission computer with a commercial off-the-shelf (COTS) multifunction display. The system will present flight, sensor, mapping, advisory, and other information for the P-8A. Qualified to MIL-STD-810F, MIL-STD-704E, and MIL-STD-461E standards, the DuraVIS 4300 offers low-temperature operation (-20C) and resistance to shock and vibration profiles that will be experienced by the P-8A. ●

COMPANY INFORMATION

Aspen Avionics

Albuquerque, N.M.
www.aspenavionics.com

Astronautics

Milwaukee
www.astronautics.com

Avidyne Corp.

Lincoln, Mass.
www.avidyne.com

BAE Systems

Farnborough, England
www.baesystems.com

Barco

Rancho Cordova, Calif.
www.barco.com

Digital Systems Engineering

Scottsdale, Ariz.
www.digitalsys.com

Esterline CMC Electronics

Ville Saint-Laurent, Quebec
www.cmcelectronics.ca

Flight Display Systems

Alpharetta, Ga.
www.flightdisplay.com

GE Aviation

Cincinnati
www.geae.com

Honeywell Aerospace

Phoenix
www.honeywell.com

Innovative Solutions & Support (IS&S)

Exton, Pa.
www.innovative-ss.com

Rockwell Collins

Cedar Rapids, Iowa
www.rockwellcollins.com

Parvus

Salt Lake City
www.parvus.com

Planar

Beaverton, Ore.
www.planar.com

Sagem Avionics

Grand Prairie, Texas
www.sagemavionics.com

Terma A/S

Lystrup, Denmark
www.terma.com

Thales

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www.thalesgroup.com

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Tucson, Ariz.
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ELECTRO-OPTICS WATCH

Night-vision devices for military bomb-disposal suits is objective of JIEDDO industry solicitation

By **JOHN KELLER**

WASHINGTON—Leaders of the Joint Improvised Explosives Device Defeat Organization (JIEDDO) in the Pentagon are asking industry to integrate night-vision devices into explosive ordnance disposal (EOD) protective bomb suits to enable bomb-disposal experts who search for, clear, and neutralize roadside bombs to operate at night or in limited illumination.



JIEDDO officials released a broad agency announcement (JIEDDO-09-EODN-VD-01) in April for the Rapid Development of Night Vision

Devices for Integration into Explosive Ordnance Disposal Bomb Suit Helmets program, which seeks to integrate night-vision sensors onto EOD bomb suits for demonstration and deployment within one to two years.

Bomb-disposal experts now have no night-vision capability for the EOD 8 and EOD 9 bomb suit, helmet, and mission because the face shield on the EOD 8 and EOD 9 helmet does not allow the PVS-7 and PVS-14 night-vision devices to work properly.

The only options currently available to EOD experts working at night are either to use a flashlight, which increases the risk of hostile fire, or open the face shield to use conventional night-vision devices and compromising protective equipment's effectiveness.

Proposals should address how to develop and test an EOD 8 and EOD 9 bomb suit helmet visor system that incorporates imaging technology and an integrated

Continued on page 40

Artificial intelligence and machine vision for unmanned vehicle smart cameras is aim of DARPA Mind's Eye program

By **JOHN KELLER**

ARLINGTON, Va.—Artificial intelligence and machine vision experts at the U.S. Defense Advanced Research Projects Agency (DARPA) in Arlington, Va., are asking industry to develop machine visual intelligence, which would enable machines to recognize not only objects, but also actions and how actions influence objects.

DARPA released a broad agency announcement (DARPA-BAA-10-53) for the Mind's Eye program to develop in machines a capability that currently exists only in animals: visual intelligence.

Of particular interest to DARPA is to develop technology for a smart camera on man-portable unmanned ground

vehicles (UGVs) with sufficient visual intelligence to report on activity in an area of observation.

The visual intelligence developed in this program would be applicable to a wide range of platforms, such as vehicle-sized UGVs, perch-and-stare micro air vehicles, or fixed surveillance cameras, DARPA officials say.

DARPA scientists would like to see proposals from developers of visual intelligence software and from systems developers who would integrate these new algorithms to create an end-to-end smart camera.

Humans and animals perform a wide range of visual tasks with ease, which no

Continued on page 39

Longwave infrared thermal camera core for unmanned vehicles introduced by FLIR

FLIR Systems Inc. in Wilsonville, Ore., is introducing the Tau 640 uncooled longwave infrared thermal camera core for small unmanned vehicles, unattended ground sensors, thermal weapon sights, helmet-mounted vision systems, security and

surveillance systems, and handheld firefighting imager applications. The Tau 640 has 640-by-480-pixel resolution, 17-micron pixel size, and digital detail enhancement image processing algorithms. FLIR's camera controller software gives users control over most Tau camera functions. For more information, contact FLIR Systems online at www.flir.com.



Logos Technologies demonstrates persistent surveillance for small UAVs

Logos Technologies Inc. demonstrated its Light Weight Expeditionary Airborne Persistent Surveillance (LEAPS) system during the Operational Adaptation Developmental Test-02 in Swansboro, N.C. LEAPS development is funded by the Office of Naval Research to provide a lightweight, persistent-surveillance capability for the Navy and Marine Corps for small unmanned aerial vehicles (UAVs). The LEAPS system is based on persistent surveillance, a new approach to intelligence surveillance and reconnaissance (ISR) that enables users to observe, record, and analyze activity over city-sized areas. "Current systems developed by Logos and other organizations weigh 500 pounds or more and are flown on a variety of manned aircraft," says Greg Poe, Logos president. "We began developing the LEAPS concept three years ago after realizing that payload size and weight significantly limit the applicability of this revolutionary new system concept. By reducing weight to less than 50 pounds, we are able to conduct persistent surveillance from many smaller UAVs that support our military forces. In addition, small, lightweight systems can be more easily integrated into multimission aircraft while not dis-

Mid-ultraviolet sensors sought by DARPA to help improve chemical and biological agent detectors

By **JOHN KELLER**

ARLINGTON, Va.—Electro-optics scientists at the U.S. Defense Advanced Research Projects Agency (DARPA) in Arlington, Va., are asking industry to develop efficient emitters of ultraviolet (UV) light at 200- to 300-nanometer wavelengths for deployable chemical/biological-agent detectors, portable water purification illuminators, and related applications.

DARPA issued a broad agency announcement (DARPA-BAA-10-45) called Compact Mid-Ultraviolet Technology calling for research proposals in middle ultraviolet emitter technology to develop heteroepitaxy, waveguides, cavities, and contacts to enable efficient light emitting diodes (LEDs) and chip-scale semiconductor lasers operating at wavelengths shorter than 275 nanometers.

These ultraviolet devices are expected to reduce size, weight, and power consumption, while improving the capability of chemical and biological detectors. DARPA officials say they expect to make several contract awards, and are allocating as much as \$35 million for the project over 24 to 30 months.

The middle ultraviolet spectral region of 200 to 300 nanometers is of significant interest for U.S. Department of Defense (DOD) applications involving detection, identification, and decontamination of biological and chemical agents, DARPA officials explain.

Amino acids and many other common biological molecules are absorbing at these wavelengths, and the resulting near-UV (300 to 400 nanometers) and visible fluorescence can signal their presence and aid in their identification in aerosol clouds, liquid suspensions, or powders.

Mature laser and detector technologies tuned to these wavelengths, however, are too heavy, fragile, and expensive for widespread military deployment at levels from platoons down to the individual warfighter.

Group III-nitride compounds and their alloys are promising for these applications because they offer the potential for electrically injected chip-scale, mid-UV sources and detectors, DARPA officials say.

The program will pursue two tracks targeting high-power, high-efficiency LEDs at 250 to 275 nanometers, and miniature UV lasers operating between 220 to 250 nanometers without nonlinear frequency conversion.

Companies interested in participating should send full proposals no later than 15 June 2010. Send questions to the DARPA program manager, John Albrecht, by

e-mail at DARPA-BAA-10-45@darpa.mil. More information is online at <https://www.fbo.gov/spg/ODA/DARPA/CMO/DARPA-BAA-10-45/listing.html>. ●

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» ELECTRO-OPTICS WATCH

L-3 Interstate Electronics to provide VideoScout-MC2 RVET systems to U.S. Marine Corps under terms of \$20 million contract

By **COURTNEY E. HOWARD**

ANAHEIM, Calif.—L-3 Interstate Electronics Corp. (IEC), a wholly owned subsidiary of L-3 Communications Corp., won a \$20.9 million contract to provide new VideoScout-MC2 Remote Video Exploitation Terminals (RVETs) to the U.S. Marine Corps.

Production of the requested units is underway, with deliveries expected in spring 2010.

A portable remote video exploitation and management system, the upgraded VideoScout-MC2 includes digital and CDL-compliant, Ku-band transceiver capabilities that provide encryption and secure communications. These communication upgrades support U.S. Department of Defense Intelligence, Surveillance, and Reconnaissance (ISR) Task Force mandates for digital and analog receiver capability

over expanded range, as well as a Ku-band transceiver. The VideoScout-MC2 comes equipped with the newest version of VideoScout Insyte software, allowing users to easily execute various functions.

"The VideoScout-MC2 is a powerful tool for critical video exploitation functions," says Bob Huffman, president of L-3 IEC. "The all-new system will be a valuable tool for military personnel, with key capabilities to better leverage captured imagery for on-the-move mission planning, execution, and post-mission analysis."

The new VideoScout-MC2 is the latest upgrade in the VideoScout product line, a line of video exploitation and management solutions for situational awareness.

At 10 pounds and integrated with receivers, VideoScout-MC2 laptops provide users with the ability to receive, exploit, and

share video and metadata from L, C, S, and Ku analog and digital communication bands used by unmanned aircraft systems (UASs) and other ISR platforms.

MC2 supports mapping, mission planning, and targeting software, in addition to other government software applications critical to the warfighter, providing a single, compact solution for improved tactical decision-making in real time.

For added capability, the system's Insyte software allows users to DVR, zoom, annotate, archive, analyze, and create derivative video for streaming and disseminating, which improves situational awareness across the battlespace.

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ELECTRO-OPTICS WATCH

Mind's Eye from page 36

current artificial intelligence can do in a robust way, DARPA officials explain. Humans have inherently strong spatial judgment, and learn directly from visual experience. At the same time, humans can visualize scenes with objects and actions, and have a powerful ability to manipulate those imagined scenes mentally to solve problems, DARPA officials say. They want the same capability for smart camera-equipped machines.

Now, apply this notion to ground surveillance, which human scouts in the Army, Force Recon in the Marine Corps, and other similar units normally perform. These units are specially trained, scarce, and work at great risk because they operate far from the main body. The current capability of ground forces to conduct persistent stare missions is limited by the number of ground forces available.

Military leaders expect a significant increase in the role of unmanned systems in future operations, including functions such as persistent stare. A significant capability area for unmanned ground systems is battlespace awareness that requires the ability to translate sensor data into a shared understanding of the environment.

An envisioned capability in that roadmap is a small robot with a sensor package that can navigate autonomously to a specified point and not only perform persistent stare in support of surveillance missions, but also detect and report on significant activity. In this way, camera-equipped UGVs would take human scouts out of harm's way.

Initial closing of this solicitation is 10 May 2010, and final closing is 21 Sept. 2010.

An industry day for program briefings will be 20 April 2010 in Washington.

More information on the industry day briefings is online at <http://tinyurl.com/MindsEyeIndustryDay>.

For questions or concerns, contact James Donlon, the DARPA program manager, by e-mail at DARPA-BAA-10-53@darpa.mil, by fax at 703-812-5052, or by post care of DARPA/TCTO, ATTN: DARPA-BAA-10-53, 3701 North Fairfax Dr., Arlington, VA 22203-1714.

More information is online at <https://www.fbo.gov/spg/ODA/DARPA/CMO/DARPA-BAA-10-53/listing.html>. ●

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placing other payloads. Miniaturization greatly expands the application space for persistent surveillance." The LEAPS system that flew was the product of a 12-month, rapid-reaction effort. LEAPS collected more than 20 hours of data over five sites, where it recorded exercise

activities in both rural and densely populated areas. Both real-time and forensic exploitation was demonstrated with Logos software. Other airborne and ground-based sensors participated with LEAPS to demonstrate coordinated collection of airborne imagery and other forms of

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» ELECTRO-OPTICS WATCH

Night-vision devices from page 36

display with integrated user controls for nighttime missions.

The system must weigh less than two pounds and be mountable onto the EOD 8 and EOD 9 bomb suit helmet within 10 minutes with common tools, without compromising any of its protective qualities and without adversely affecting the helmet functions; have a minimum field of view of 32 degrees in the horizontal direction and 24 degrees in the vertical; offer adjustable focus from 18 inches to infinity; include a near-infrared illuminator; have battery power for three hours on one set of batteries; have break-away cable connectors; and be either binocular or monocular.

JIEDDO seeks proposals that quickly adapt existing night-vision technologies to meet size, weight, and power requirements for bomb suits.

The JIEDDO Reading Room has information on JIEDDO's capability gaps, emerging critical initiatives, new developments, as well as studies, documents, and other items of interests for defeating IEDs online at www.jieddo.dod.mil/rr.aspx.

Companies interested in participating should send proposals no later than 4 June 2010. Send proposals to the JIEDDO bids Web site at <https://bids.acqcenter.com/JIEDDO>.

For questions or concerns, phone the JIEDDO's Mark Keller at 703-601-5756, or Dick Chladek at 703-602-5476. More information is online at https://www.fbo.gov/index?s=opportunity&mode=form&id=5526b65dafb851cf83d1fac6055aae31&tab=core&_cview=0. ●

intelligence. Logos will continue to develop the LEAPS payload and other lightweight, persistent-surveillance systems.

Military-hardened video camera introduced by Sensors Unlimited

Sensors Unlimited in Princeton, N.J., is introducing a military-hardened uncooled, indium gallium arsenide (InGaAs) short-wave infrared (SWIR) video camera for military applications. The small, high-sensitivity SU320HX rugged video surveillance camera is for military imaging systems deployed in harsh environments. Shortwave infrared imaging systems based on InGaAs technology can image through atmospheric obscurants, such as haze, fog, smoke, and dust. This combines with the ability to image during daytime or nighttime, including "cross-over" hours at dawn and dusk, making InGaAs-SWIR video cameras especially useful for surveillance in manned and unmanned airborne and/or ground systems. The SWIR camera also is for surveillance applications and maritime intelligence tasks. For more information, contact Sensors Unlimited, part of Goodrich Corp., online at www.sensorsinc.com. ●

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» PRODUCT APPLICATIONS

DATA STORAGE

Rugged data storage system from Curtiss-Wright to be designed into Canadian maritime patrol aircraft

Avionics designers at MacDonald, Dettwiler and Associates Ltd. (MDA) in Richmond, British Columbia, needed high-altitude rugged data storage systems for the Canadian CP-140 Aurora maritime patrol aircraft. They found their solution from The Curtiss-Wright Controls Electronic Systems segment in Dayton, Ohio.

MDA awarded a \$1.17 million contract to Curtiss-Wright for its SANbric storage area network (SAN) storage system for the Canadian CP-140, a variant of the U.S. Navy P-3 Orion maritime patrol aircraft.



The SANbric units for MDA will be manufactured by the Curtiss-Wright Electronic Systems facility in Littleton, Mass. For more information, contact Curtiss-Wright online at www.cwcembedded.com, or MDA at www.mdacorporation.com.

systems in the military/aerospace, telecommunications, transportation, and industrial control markets, Aonix PERC Ultra is used by Lockheed Martin in its Aegis Weapon System, providing deterministic, real-time performance, and high-productivity development. Aonix PERC Ultra also provides instrumentation and VM management tools to support the mission-critical, real-time requirements of the Aegis Weapon System.

James B. Gambrell, executive chairman at Atego, says: "As a supplier to mission- and safety-critical system developers, we understand that building large, complex and operationally intensive systems is incredibly demanding, and Atego is pleased to be part of this winning team."

The Aegis Weapon System is the premier naval defense system and the sea-based element of the U.S. Ballistic Missile Defense System. Its precision SPY-1 radar and integrated command and control system guides the interceptor and uplinks target track information to the missile for terminal homing. Its ability to detect, track, and engage targets ranging from sea-skimming cruise missiles to ballistic missiles in space is proven.

"The combat readiness trials assert rigorous stress on the systems they test," says Jim Sheridan, Lockheed Martin's director, Aegis U.S. Navy Programs. "We appreciate Atego's technical team's dependability, responsiveness, and support during our development and testing cycle."

COMMUNICATIONS AND NETWORKING

Honeywell Technology Solutions to provide technology support for Navy LAMPS program

Honeywell Technology Solutions Inc. (HTSI) in Phoenix announced it won a \$51 million, five-year contract by the Naval Air Warfare Center Aircraft Division (NAWCAD) to provide design, development, integration, testing, evaluation, maintenance, and logistics support for the Light Airborne Multi-Purpose System (LAMPS), the ship-board element of a two-way digital data link between a U.S. Navy ship and a SH-60 helicopter.

"Honeywell began serving the U.S. Navy for the LAMPS system 28 years ago," says Vince Trim, president, HTSI. "Now, Honeywell will provide the Navy with advanced technologies and capabilities as we install a major upgrade to the system

RF AND MICROWAVE

Wideband radome delivered for F-15 program

A major part of the F-15 Radar Modernization Program (RMP) calls for a new wideband nose radome, which was designed by General Dynamics Armament and Technical Products in Charlotte, N.C.

The RMP radome will fly on the U.S. Air Force F-15E as part of the RMP upgrade. Benefits of the radome include superior electrical performance over a wide frequency range, low weight, low part count, and the ability to perform in high heat and stress environment. The radome also includes the installation and integration of an instrument landing system antenna.

"We are pleased to achieve this program milestone on schedule and within budget to support Boeing's work on the F-15 RMP," says Jim Losse, vice president and general manager of advanced materials for General Dynamics Armament and Technical Products. "Our team in Marion has built wideband radomes for years, and we are excited to add the F-15 RMP nose radome to our facility and workforce's capabilities."

The SDD contract scope includes radome design, material strength and environmental testing, environmental and structural qualification, tool design, fabrication, assembly, and repair-methods development. Production and program management is being performed at General Dynamics' advanced materials facility in

Marion, Va. Ten radomes will be built as part of the SDD phase, with deliveries completed in April 2011.

SOFTWARE

Aonix PERC Ultra Virtual Machine supports Lockheed Martin's Java components in Aegis Weapon System aboard guided missile cruiser USS Bunker Hill

Atego—an independent supplier of industrial-grade, collaborative development tools for engineering complex, mission- and safety-critical architectures, systems, software, and hardware—has announced the deployment of its Aonix PERC Virtual Machine technology in support of Lockheed Martin's Java language components used in the Aegis Open Architecture System during recent combat tests. The guided missile cruiser USS Bunker Hill (CG 52), modernized with the Aegis Weapon System, completed an operational trial of its full combat system.

Deployed in thousands of fielded



» PRODUCT APPLICATIONS

under this new contract, which will extend the monitoring ability of both the ship and helicopter through radar and sonar.”

In addition to providing engineering support for the equipment production and upgrade, HTSI provides support to the fleet around the world for maintenance, testing, and repair.

A wholly-owned subsidiary of Honeywell International, HTSI provides a range of services for government customers in management, space systems and services, networks and field engineering, Department of Defense logistics, depot maintenance, staff augmentation, calibration, information technology, and cyber security.

COMMUNICATIONS EQUIPMENT

Harris to provide Falcon III JTRS-compatible radios for M-ATV military vehicles in \$74 million order

The Harris Corp. RF Communications Division in Rochester, N.Y., will provide Joint Tactical Radio System (JTRS)-

million order announced in January. The Harris Falcon family of software-defined radio systems encompasses manpack, handheld, and vehicular applications.

Falcon III supports the U.S. military's JTRS requirements, as well as network-centric operations. For more information, contact Harris RF Communications online at www.rfcomm.harris.com.

SPACE ELECTRONICS

Navy chooses spacecraft bus from AeroAstro for JMAPS microsatellite mission to map the stars

U.S. Navy researchers needed a spacecraft bus for the Joint Milli-Arcsecond Pathfinder Survey (JMAPS) mission. They found their solution from AeroAstro Inc. in Ashburn, Va.

AeroAstro, a subsidiary of Comtech Telecommunications Corp. in Melville, N.Y., won a \$37.9 million contract from the Naval Research Laboratory in Washington to provide the company's Astro 200AS bus to host the JMAPS instrument over a three-year mission life.

The JMAPS mission is primarily intended to update the star position catalog for critical national security and civil applications. JMAPS covers the magnitude range of 1–12, with extended results through 15th magnitude at an accuracy of 1 milliarcsecond (mas) positional accuracy at a mean observing epoch of approximately 2013. JMAPS will use a relatively modest aperture astrometric telescope flown in low earth orbit (LEO) aboard a microsatellite.

“The capability offered by this spacecraft enables a range of new high-value mission and sensor options on an affordable platform that can be rapidly developed and deployed,” says AeroAstro president Paul Lithgow.

For more information, contact AeroAstro online at www.AeroAstro.com.

POWER ELECTRONICS

Radio battery backup electrical power systems from Ultralife Corp. headed to Army and Marine Corps

Ultralife Corp. in Newark, N.Y., is providing its McDowell Research brand MRC-93 Ultimate Battery Eliminator for U.S. Army and Marine Corps manpack radios and other portable military electronic equipment under terms of contracts worth about \$2 million, company officials say.

The MRC-93 is a universal self-contained



battery eliminator that connects directly to a radio transceiver replacing the battery box. It can connect to a wide variety of military radio communications transceivers, such as the AN/PRC-117F and AN/PRC-138 multi-band manpack radios, among others.

The MRC-93 provides regulated DC power output from an external AC or DC power source to operate DC-powered equipment. This encompasses most AC generating systems on aircraft, ships, and other power sources, including solar, wind, and diesel generators. Deliveries should be finished by late this spring.

The Eliminator also can use any communications batteries as backup power should the unit lose AC or DC input power. For more information, contact Ultralife online at www.ultralifecorp.com.

RUGGED COMPUTERS

Z Microsystems partners with Eurolink Systems to deliver rugged servers to Italian Navy

Z Microsystems, a provider of mission-ready computing systems, has partnered with Eurolink Systems, an Italy-based defense systems integrator, to provide its ZX series of rugged computer servers to the Italian navy. Eurolink Systems will supply the ZX1, ZX2, and ZX3 servers to a global communication supplier for integration into on-board computing systems used in the FREMM European multimission frigate program.

The FREMM European multimission frigate is a joint program between France and Italy that originally included plans for a total of 27 FREMM frigates to be built: 17 for the French Navy and 10 for the Italian Navy. The frigate is a ship designed to operate in anti-air, anti-submarine, and anti-ship warfare, with the capability of carrying out deep strikes against land targets.

“We are happy to working with Z Microsystems to integrate their rugged servers for this very important program,” says Pietro Lapiana, CEO of Eurolink Systems. “Partnering with Z Microsystems allows us to deliver a complete turnkey offering of products, services, and applications in the defense and aerospace markets in Europe.”

Continued on page 46



approved Falcon III AN/PRC-152(C) multiband handheld radios in vehicular amplifier adapters for the U.S. military Mine Resistant Ambush Protected All-Terrain Vehicles (M-ATVs) under terms of a \$74 million order.

The Falcon III AN/PRC-152 radio communications system, which serves as the handheld software-defined radio transceiver in the Falcon III AN/VRC-110 vehicular amplifier adapter system, will provide MRAP users with demand assigned several access (DAMA) satellite communications.

These orders are a follow-on to the \$119

NEW PRODUCTS

To submit new products for consideration, contact John Keller by e-mail at jkeller@pennwell.com

» EMBEDDED COMPUTING

AMC computer board with Intel Xeon processor introduced by Kontron AG

Kontron AG in Eching, Germany, is introducing the AM5030 Advanced Mezzanine Card (AMC) computer board with quad-core processor for



dense server environments deployed in storage, military and aerospace, and communications networks such as IPTV, VoIP, NAS, SAN, and wireless radio network controllers. The AM5030 double-wide, full-size AMC embedded computer has the Intel Xeon processor LC5518, which is based on Intel 45-nanometer microarchitecture and PCI Express Gen 2.0 I/O within the processor. In addition, the embedded processor offers as much as eight megabytes of shared last level cache, Intel hyper-threading technology support, Intel Turbo Boost technology, Intel 3420 platform controller hub (PCH), Direct Media Interface (DMI), and integrated redundant array of independent disks (RAID) acceleration. The Kontron AM5030 hosts as much as 24 gigabytes ECC memory (DDR3) at 1066 MHz implemented as a 3-channel interface, and is built with two 10 Gigabit Ethernet (XAUI) interfaces in accordance with AMC.2 for networking capabilities. The AMC.1/2/3-compliant Kontron AM5030 AdvancedMC processor module has hot-swap capabilities for replacing, monitoring, and controlling the module without the need to shut down the MicroTCA system. The Kontron AM5030 supports RedHat Linux, Windows 7, Windows XP, and Windows 2008 Server. For more information, contact Kontron online at <http://de.kontron.com/>.

» POWER ELECTRONICS

Power management device for armored vehicle power applications introduced by DDC

Data Device Corp. (DDC) in Bohemia, N.Y., is introducing its third-generation RP-26200 solid-state power controller (SSPC) for military armored vehicle applications and unmanned ground vehicles (UGVs). The power electronics device has enhancements such as higher power output, low power dissipation, and extended operating temperature, compared to previous generations. DDC's RP-26200 power controller provides solid-state protection, control, and power management for 16 independent 28-volt DC channels, with power output of more than 8 kilowatts. Programmable trip points, channel paralleling, and power-on defaults support maximum power distribution system flexibility for vehicle electronics. The RP-26200 vehicle power device is based on established DDC technology, with more than 500,000 nodes installed since 1988 on vehicles including the M1A2 Abrams main battle tank and



the M2 Bradley Fighting Vehicle, and on future unmanned ground vehicles and tactical wheeled vehicles. The RP-26200's embedded controller and network interface enable real-time load monitoring for load management and preventive maintenance. The RP-26200 is for tactical wheeled vehicles "where weight, size, and flexibility are at a premium, and where reliability under harsh operation is vital to mission success," says Steve Rood Goldman, DDC's marketing manager. For more information, contact DDC online at www.ddc-web.com.

» DATA STORAGE

Low-power SATA mass storage PMC/XMC device released by Aitech

Aitech Defense Systems Inc. in Chatsworth, Calif., released the M224, a single-width SATA mass storage PMC/XMC that consumes a maximum



of only 4 watts. The new M224 uses a specialized thermal frame design for heat dissipation and with no moving parts for improved reliability. The rugged, solid-state M224 integrates with a number of host boards in a variety of harsh applications, such as program and variable data storage, detailed area moving maps with red/blue force tracking, large databases, radar or sonar images, as well as software programmable radio electronic intelligence (ELINT) data and other graphical data. Low risk and low cost application integration is aided by the onboard PCI Express and PCI-X controllers combined with the board's PMC/XMC connectors.

Automatic detection circuitry configures the M224 for either PMC or XMC operation, enabling the board's use in either application. The M224's twin banks of large, programmable NAND Flash, which provide a maximum combined capacity of 128 gigabytes, are each managed by their own quad-channel SSD controller. This enables the tandem memory banks to operate as independent SATA II Flash disks and optimizes the board's performance by implementing interleaving and parallel operation between the channels to eliminate the low access times normally associated with Flash-based devices. For more information, visit <http://www.rugged.com/m224.htm>.

» NEW PRODUCTS

» DESIGN AND DEVELOPMENT TOOLS

Design tool for DO-254-based complex airborne electronics hardware design introduced by The MathWorks and Mentor Graphics

The MathWorks in Natick, Mass., and Mentor Graphics in Wilsonville, Ore., are working together to provide guidance on an integrated workflow for compliance to the RTCA/DO-254 design assurance guidance for airborne electronics hardware standard using model-based design. DO-254 is recognized by the U.S. Federal Aviation Administration (FAA) as a means for designing complex electronic hardware like field-programmable gate arrays (FPGAs), programmable logic devices (PLDs), and application specific integrated circuits (ASICs) in avionics systems. The DO-254 standard is the counterpart to the RTCA DO-178B/EUROCAE ED-12B standard for software in safety-critical systems. The two companies are combining tools to support model-based design throughout all stages of development, including requirements definition and management, conceptual and detailed design, implementation, and testing. Using this integrated workflow, aerospace engineers can verify designs early, implement in HDL quickly, reuse design and verification, and better manage requirements and test cases. More information on adopting model-based design for DO-254 certification with MathWorks tools is online at www.mathworks.com/do-254. The Mentor Graphics DO-254 approach is detailed online at www.mentor.com/go/do-254. An online whitepaper in .pdf format explains the joint workflow.

» RUGGED COMPUTERS

Rugged computer for military shipboard, vetronics, and avionics applications introduced by Crystal Group

Crystal Group Inc. in Hiawatha, Iowa, is introducing the TCM2 tactical computing module for military shipboard computing, aircraft avionics applications, and land-

based embedded computing. The TCM2 rugged computer operates in temperatures from -40 to 65 degrees Celsius and in random vibration of 7.18 GRMS. The harsh-environment computing module runs on a standard 10-36 volts DC power supply, which



enables it to run on conventional vehicle power. The TCM2 can also be configured with as many as eight additional 2.5-inch rotational or solid-state hard drives with the addition of a bolt-on expansion base. The module also comes with MIL-C-26482 military circular connectors. The TCM2 military computer comes with MIL-STD-461E filtering, and runs on a dual-core 2.53 GHz Intel Core 2 Duo microprocessor, as much as 8 gigabytes of RAM, low-profile PCI Express expansion capabilities, and rugged data storage of two 2.5-inch rotational or solid-state hard drives. For more information, contact Crystal Group online at www.crystalrugged.com.

» EMBEDDED COMPUTING

Rugged single-board computer module with Intel Core 2 Duo processor introduced by GE

Embedded computer specialist GE Intelligent Platforms in Charlottesville, Va., is introducing the bCOM2-L1100 rugged COM Express computer board for use in harsh-environment, space-constrained applications such as aerospace and defense, unmanned vehicles, oil and gas exploration, and mining. The bCOM2-L1100 computer boards the Intel Core2 Duo processor operating as fast as 2.26 GHz and as much as 4 gigabytes of soldered DDR3 SDRAM solid-state memory. The bCOM2-L1100 single-board computer operates in temperatures from -40 to 85 degrees Celsius, and is optionally available in extended

temperature variants and with conformal coating. A carrier board is required for the bCOM2-L1100 CPU board. The CCAR-L1000 carrier board is available for initial development and testing. I/O includes Gigabit Ethernet, eight USB 2.0 ports, four Serial ATA (SATA) ports (RAID-configurable), one PATA port, eight GPIO ports (four in, four out), one LVDS port, two SDVO channels, VGA, High Definition Audio (HDA), and PCI Express (configurable as one 4x PCI Express lane or four 1x PCI Express lanes). Also provided is a x16 PCI Express port for high-end graphics and video applications. For more information, contact GE Intelligent Platforms online at www.ge-ip.com.

» POWER ELECTRONICS

AC/DC front-end power supply for hot-swap applications introduced by Murata Power

Murata Power Solutions in Mansfield, Mass., is introducing the D1U4CS-W-2200-12-HA4C AC/DC front-end power supply for hot-swapping redundant systems that meets Climate Savers' 80+ Gold efficiency rating. The 2200-watt, 220-volt AC and 1100-2att, 110-volt AC, power-factor corrected power electronics device has a main output of 12 volts and a standby output of 5 volts. Designed for delivering high-density bulk power to servers, workstations, storage systems, and other 12-volt distributed power architecture applications, the D1U4CS-W-2200-12-HA4C is packaged in a 1U 14-by-4-by-1.6-inch enclosure, with built-in variable speed cooling fans. The unit is N+1 redundancy capable including hot-docking, and if required, four units can



NEW PRODUCTS

be packaged into an optional 19-inch 1U power shelf to provide as much as 8.8 kilowatts of power. The D1U4CS-W-2200-12-HA4C has power density of 24.5 watts per cubic inch, and achieves efficiency levels of between 92 percent (at 50 percent load) and 88 percent (at 20 percent load). The RoHS-compliant D1U4CS-W-2200-12-HA4C has an operating temperature range of 0 to 50 degrees Celsius, mean time before failure (MTBF) of 400,000 hours, and complies with CSA 60950-1-03/UL 60950-1 safety approvals. For more information, contact Murata Power Solutions online at www.murata-ps.com.

» AVIONICS

MIL-STD-1553 and ARINC-429 avionics data bus cards introduced by DDC

Data Device Corp. (DDC) in Bohemia, N.Y., is introducing a line of rugged MIL-STD-1553 and ARINC-429



embedded and test avionics data bus cards designed around its next-generation AceXtreme 1553 core, which adds Multi-RT capability to DDC's data bus technology. The cards have a common API that can be used for test cards, embedded cards, and components to simplify application code development, shorten software development time, and mitigate risk, while the I/O mix and high channel count of the hardware reduces space, power, weight, and cost, DDC officials say. AceXtreme cards are available in conduction-cooled or air-cooled versions, in PC/104-Plus, PCI/104, PCI Mezzanine Card (PMC), PCI, and CompactPCI form factors. The

cards are for systems with limited space yet high I/O requirements, with a combination and mix of MIL-STD-1553, ARINC 429, Digital Discrete I/O, Avionics Discrete I/O, RS-232/422/485 Serial I/O, and IRIG-B input/output on one rugged. The cards have IRIG-106 Chapter 10 on-board formatting, user selectable BC disable/TX inhibit for safety critical applications, and an onboard DMA engine for increased data throughput and low host CPU/PCI use. The cards have a common test/embedded API that minimizes software development time by enabling programmers to use the same software across products, platforms, and applications. For more information contact DDC online at www.ddc-web.com.

» TEST AND MEASUREMENT

VITA 46 VPX test backplane for board developers introduced by Elma Bustronic

Elma Bustronic Corp. in Fremont, Calif., is introducing a two-slot test backplane for VPX board developers and integrators. The two-slot test backplane, designed to VITA 46 specifications, enables the user to power up and test J1 fabric connections as if he were interconnected in the target application. Signals can be passed from one slot to the next via high-speed interconnect cables, via signals introduced through the J1 fabric connector, or accessed on the J1 fabric connector using the test backplane's SMA and SATA cable headers. The test backplane accepts 6U cards with the 3U card size supported by use of a shelf divider. For convenience in attaching probes, the slot pitch is 1.6 inches. The VPX test backplane solves a signal access issue with VPX systems that use rear transition module (RTM) boards. VPX cards are usually developed together with an RTM



module that does not access the J1 fabric signals. In conventional designs, an engineer cannot probe these J1 fabric signals while using the device under test's (DUT) RTM module to access other IO signals. The Bustronic solution enables the primary J1 fabric signals to be accessed and connected without interfering with the use of an existing RTM module for J2-J6 IO connector signals. Custom backplanes often must interconnect the primary fabric signals between several VPX blades for a specific application. The VPX test backplane enables the user to interconnect two or more such blades before investing the time or expense of a custom VPX backplane. For more information, contact Elma Bustronic online at www.bustronic.com.

» RF AND MICROWAVE

250-watt microwave power amplifier that spans 1750 to 1850 MHz introduced by AR

AR Modular RF in Bothell, Wash., is introducing a Class AB solid-state power amplifier that delivers in



excess of 250 watts continuous wave power into a 50-ohm load over the frequency range of 1750 to 1850 MHz. The company's new Model KAS2010M12 power electronics device is a 19-inch rack-mount unit that features overdrive protection, infinite mismatch tolerance/VSWR protection, and over-temperature protection. Included in the KAS2010M12 is the KMS2010 module. The KMS2010 is also available for purchase separately. It is capable of providing as much as 150 watts of power over the 1.75 to 1.85 GHz frequency range. For additional information, contact AR Modular RF online at www.ar-worldwide.com. ●

» PRODUCT APPLICATIONS

Continued from page 42

The new ZX 1-2-3 series are low-profile, rack-mountable, rugged servers from Z Microsystems. The ZX1 is 1.72 inches (1U) high, the ZX2 is 3.45 inches (2U) high, and the ZX3 is 5.25 inches (3U). All are 20 inches deep. Each is compact and lightweight, saving rack space while delivering a flexible, high-performance solution for mission-ready applications.

"As in the U.S., the European military is looking for less size and weight, more flexibility, and higher performance in computers and servers," says Jack Wade, CEO of Z Microsystems. "Eurolink Systems has been a great partner for us to be able to penetrate this market and show that our servers are the best suited for these types of applications."

The ZX 1-2-3 Series integrates the latest computing technology with a system architecture supporting any extended ATX form-factor motherboards with support for up to 3, 6, or 12 rugged hot-pluggable TP2

removable drives, a slim line DVD-RW dual layer, and an environmental control board to support proper thermal regulation.

The ZX 1-2-3 Series, designed and built for the harshest military environments, sports a chassis designed to meet MIL-STD-810G requirements for shock, vibration, humidity, and high/low temperature.

DATA BUSES AND NETWORKING

GE Intelligent Platforms COTS Ethernet switch selected for network control on International Space Station

GE Intelligent Platforms has secured orders from Goodrich Corp.'s ISR Systems in Albuquerque, N.M. Goodrich will produce a custom version of the GE Intelligent Platforms NETernity RM924RC Ethernet switch, which will form part of the network control system of the iPEHG (improved Payload Ethernet Gateway) on the International Space Station (ISS).

"Using a commercial off-the-shelf (COTS)



solution like the RM924RC as the basis of its design provided an advantage, enabling Goodrich to bring the iPEHG to market quickly," says Peter Cavill, general manager, Military & Aerospace at GE Intelligent Platforms.

Goodrich's customer is Boeing, a prime contractor to NASA for the ISS program.

The NETernity RM924RC is a managed layer 2/3+ Ethernet embedded switch offering IPv6 wire speed switching and routing and the GE Intelligent Platforms OpenWare switch management environment. With 24 rear I/O ports, the RM924RC is designed to meet the needs of networking and switching applications, facilitating communications within a chassis as well as supporting the network outside the chassis. ●

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DATA STORAGE TECHNOLOGY

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MILAERO BLOG

DSP performance of the Intel Core i7 microprocessor

Just when embedded computing developers are getting used to the benefits of the Intel Core i7 microprocessor, such as floating-point processing for high-performance digital signal processing (DSP), they have something new to get excited about. The DSP performance of the Core i7, for some applications, is about to double. This should be welcome news for embedded computer developers for DSP-heavy applications like radar processing, signals intelligence, and electronic warfare.

Better yet, Intel chip designers will not change the dimensions or pin connections of the new Core i7 microprocessors, which means single-board computer designers will be able to integrate these chips without redesigning the boards.

Peter Carlston, platform architect of the Intel Corp. Embedded and Communications Group in Chandler, Ariz., says Intel will offer versions of the Core i7 early next year with vector registers increased from four to eight.

more <http://www.pennwellblogs.com/mae/>

DEFENSE EXECUTIVE

When combat vehicles fly

Scientists at the U.S. Defense Advanced Research Projects Agency (DARPA) in Arlington, Va., are asking industry to develop and demonstrate a vertical takeoff and landing (VTOL) capability to enable the vehicle to fly over obstructions and rough terrain. DARPA released a broad agency announcement (BAA solicitation 10-52) for the Transformer (TX) Vertical Takeoff and Landing Roadable Air Vehicle program, which seeks to develop a four-person flyable/roadable vehicle that provides the warfighter terrain-independent mobility. The TX vehicle will have a minimum combat range of 250 nautical miles on one tank of fuel. The focus is to develop a suite of technologies that enable dual-mode transportation and a combat range comparable to today's military helicopters.

more <http://bit.ly/bl02xC>

AVIONICS INTELLIGENCE



Installing new avionics in a downturned economy

Panelists from American Airlines, Boeing, Honeywell, and Rockwell Collins will discuss ways to integrate new avionics into airplanes in a down economy at the 2010 Avionics USA conference and exhibition to be held June 3-4, 2010 at the San Diego Convention Center in San Diego.

Panelists are Capt. Brian Will, director airspace modernization and advanced technologies, American Airlines; Chad Cundiff, vice president of crew interface products at Honeywell Aerospace; Joel Otto, senior director, commercial systems marketing for Rockwell Collins; and Rudy Bracho, senior manager of business development, Boeing Commercial Airplanes.

The keynote speaker is Steve Vail, senior advisor, FedEx Global Air Traffic Operations. Session topics include: NextGen Air Traffic Management (ATM): Reality, Concept, Methodologies; Air Traffic Management Integration & Regulatory Issues; Performance-Based Operations; Military Avionics Systems and NextGen; and NextGen Safety Technology, Moving Maps, Terrain Warning Systems, and EFBs.

more <http://www.avionics-intelligence.com>



COMMAND POST COMMUNITY

Chips in space

Consider the challenges of verifying FPGA-based designs for an aerospace company whose devices have been to the moon and beyond. First are the everyday terrestrial concerns: due to size and complexity, most modern FPGA designs are difficult to verify with traditional directed tests. Then havoc-wreaking radiation in space requires trading inexpensive reprogrammable parts for

pricey radiation-tolerant parts. The challenges lead to one goal: reducing the number of logic changes during lab testing, saving on the number of devices used and the time and expense of circuit-board changes or remounting new parts. This was the context when SEAKR Engineering sought to improve its verification methodology. The company adopted constrained-random testing using Open Verification Methodology, which led to faster, more effective testing and more business opportunities for the company.

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